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அடிப் படைக் கற்கைகளுக் கான தேசிய நிறுவகம்
NATIONAL INSTITUTE OF FUNDAMENTAL STUDIES



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வருடாந்த அறிக்கை
ANNUAL REPORT
2018

විද්‍යා, තාක්ෂණ, පර්යේෂණ, නිපුණතා සංවර්ධන හා වෘත්තීය පුහුණු
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விஞ்ஞான, தொழில்நுட்ப, ஆராய்ச்சி, திறன்கள் அபிவிருத்தி மற்றும்
வாழ்க்கைத் தொழிற்பயிற்சி மற்றும் கண்டி மரபுரிமைகள் அமைச்சு

**Ministry of Science , Technology, Research, Skills Development
& Vocational Training and Kandyan Heritage**



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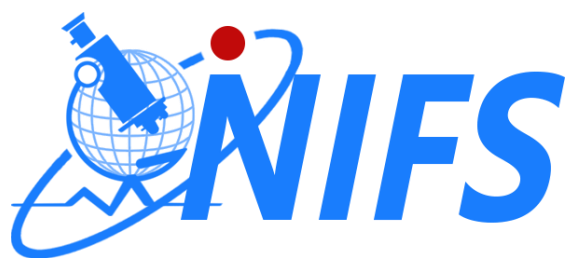


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Ministry of Science Technology & Research

National Institute of Fundamental Studies



ANNUAL REPORT

2018

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**** Please consider the English Medium document as the Main Report, since the working medium of the Institute is English Language**

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1. INTRODUCTION

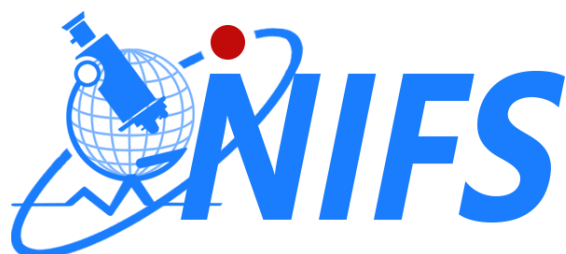
National Institute of Fundamental Studies

Vision

“To be a world-renowned center of excellence for research in fundamental studies.”

Mission

“Initiate, promote and Engage in advanced research in fundamental studies for the enhancement of scientific knowledge, human resources, and national development”



Director's Message

The NIFS is mandated to conduct research into fundamental studies in general, taken in the broadest sense, in the natural sciences, social sciences and philosophy.

The scientists of NIFS who are renowned in their fields have a great deal of freedom in choosing their areas of work and research projects. They are expected to carry out research at the cutting edge of science or on projects which will have an impact on problems faced by the people of Sri Lanka.

Although I have been the Director only for a few months this year, I am well aware of the impact the work of our scientists is having, the contribution that NIFS makes on popularizing science particularly among school children and the support provided by the technical and administrative staff in ensuring the smooth operation of the Institute.

I am excited to take on the challenge of finding new ways to make this great Institute even better. In particular, I would like to focus on enhancing research collaboration and promoting graduate education.

Prof. Saman Seneweera

Director/National Institute of Fundamental Studies

OBJECTIVES OF THE INSTITUTION

- ❖ Initiate, promote and conduct research and original investigations to fundamental studies in general with particular emphasis on mathematics, physical and chemical sciences, life sciences, social sciences and philosophy, taken in the broadest sense to collaborate with public and private institutions as may be necessary to develop applications relevant to the studies conducted.
- ❖ Arrange lectures, meetings, seminars, and symposia in pursuance of its research work and for the diffusion of scientific knowledge;
- ❖ Invite scientists in Sri Lanka and from abroad, who are actively engaged in creative work to deliver lectures and participate in its research activities;
- ❖ Establish and maintain liaison with scientific workers and scientific institutions in other countries and promote international co-operation in matters relating to the aims and objects of the Institute, while taking care to protect and promote the national interest;
- ❖ Provide training, guidance, and assistance for research leading to the award of post graduate degrees by institutions recognized by the University Grant commission established by the University Act, No.16 of 1978.
- ❖ Do such other acts and things as may be necessary to promote the aims and objectives of the Institute.

The institutional research objectives were met through six research units under 19 research projects mentioned below and the technical and administrative staff ensure the smooth operation of the Institute.

ENERGY & ADVANCED MATERIALS RESEARCH UNIT

Condensed Matter Physics & Solid State Chemistry
Energy & Advanced Material Chemistry
Material Processing & Device Fabrication
Nanotechnology & Advanced Materials

THEORETICAL PHYSICS & COMPUTATIONAL STUDIES RESEARCH UNIT

Quantum Physics & Applied Electronics

NATURAL PRODUCT & FOOD CHEMISTRY RESEARCH UNIT

Food Chemistry
Natural Products
Nutritional Biochemistry

MICROBIOLOGY & CARBON SEQUESTRATION RESEARCH UNIT

Bioenergy & Soil Ecosystems
Rhizobium Project
Microbial Biotechnology

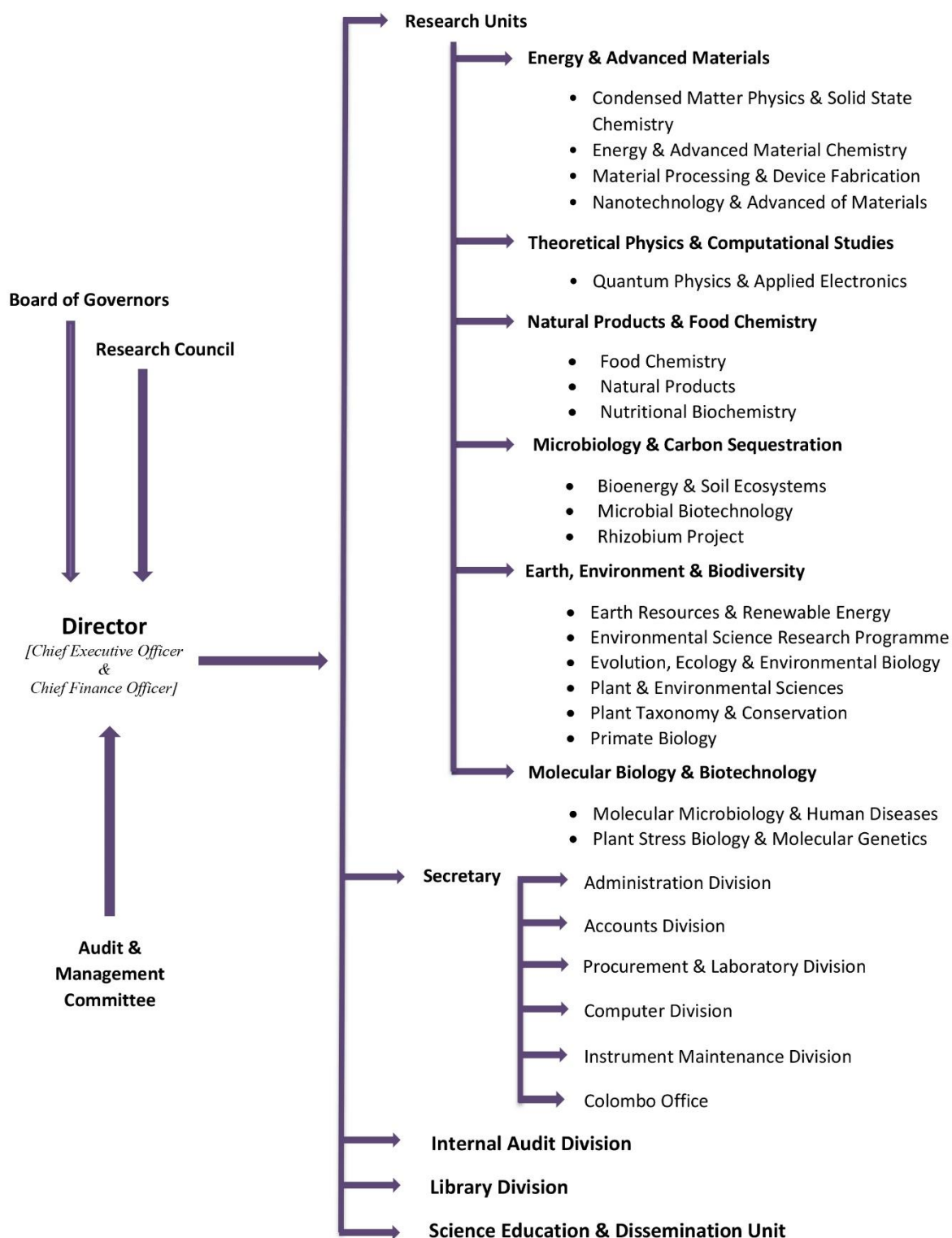
EARTH, ENVIRONMENT & BIODIVERSITY RESEARCH UNIT

Earth Resources and Renewable Energy
Environmental Science Research Programme
Evolution, Ecology & Environmental Biology
Plant & Environmental Sciences
Plant Taxonomy & Conservation
Primate Biology

MOLECULAR BIOLOGY & BIOTECHNOLOGY RESEARCH UNIT

Molecular Microbiology & Human Diseases
Plant Stress Biology & Molecular Genetics

2. ORGANIZATIONAL CHART



3. BOARD OF GOVERNORS 2018

NIFS is administered by a twelve-member Board of Governors including Prof. Vijaya Kumar as the Chairman.

Chairman -Appointed by H.E the President

- **Prof. Vijaya Kumar**, Emeritus Professor of University of Peradeniya

Members

Ex-Officio members

- The Advisor to the President on Scientific Affairs
- **Prof. Mohan De Silva**, Chairman/ University Grants Commission
- **Prof. L. Jayasinghe**, Acting Director/ NIFS up to 3rd June 2018
- **Prof. Saman Seneweera**, Director/ NIFS (appointed on 4th June 2018)

Appointed by H.E the President

- **Prof. M.A.K.L. Dissanayake**, Research Professor/ NIFS
- **Prof. N.G.J. Dias**, Department of Computer Systems Engineering/ University of Kelaniya
- **Dr. W.K.B.N. Prame**, Former Director General/ Geological Survey & Mines Bureau

Appointed by the Minister

- **Prof. C.P. Deepal W. Mathew**, Department of Biochemistry and Molecular Biology/ University of Colombo
- **Prof. M.J.S. Wijeyaratne**, Senior Professor of Zoology & Environmental Management, Univ. of Kelaniya, Chairman/ National Science & Technology Commission

Elected by the Research Council

- **Prof. Namal Priyantha**, Department of Chemistry, University of Peradeniya
- **Prof. U.L.B. Jayasinghe**, Senior Research Professor/ NIFS

Appointed by the Treasury

- **Mr. J.M.U.P. Jayamaha**, Additional Director General/ Dept. of Public Enterprises, Ministry of Finance

Secretary to the Board of Governors/ NIFS

- **Dr. P.S.B. Wanduragala**

4. RESEARCH COUNCIL 2018

A Research council whose membership comprises university academics and researchers of the NIFS, serves as an advisory body.

Chairman

- Prof. Saman Seneweera, Director/ NIFS (appointed on 4th June 2018)

Members

Appointed by H.E the President

- Prof. D.M.D. Yakandawala, Department of Botany, Faculty of Science, University of Peradeniya
- Prof. Ruwan Duminda Jayasinghe, Faculty of Dental Studies, University of Peradeniya (up to 6th October 2018)

Nominated by the University Grant Commission

- Prof. H.M.D. Namal Priyantha, Department of Chemistry, Faculty of Science, University of Peradeniya
- Prof. R.L. Chandrajith, Department of Geology, Faculty of Science, University of Peradeniya
- Prof. G.K.R. Senadeera, Department of Physics, The Open University of Sri Lanka
- Prof. L.R. Jayasekara, Department of Botany, Faculty of Science, University of Kelaniya

Ex-Officio:

Senior Research Professors, Research Professors, Associate Research Professors & Senior Research Fellows of National Institute of Fundamental Studies

- Prof. A. Nanayakkara, Senior Research Professor
- Prof. J. Bandara, Senior Research Professor
- Prof. U.L.B. Jayasinghe, Senior Research Professor
- Prof. G. Seneviratne, Senior Research Professor
- Prof. M.A.K.L. Dissanayake, Research Professor
- Prof. D. S. A. Wijesundara, Research Professor
- Prof. G.R.A. Kumara, Research Professor
- Prof. R. Weerasooriya, Research Professor
- Prof. S.P. Benjamin, Associate Research Professor
- Prof. M.C.M. Iqbal, Associate Research Professor
- Prof. N.D. Subasinghe, Associate Research Professor
- Prof. D.N. Magana-Arachchi, Associate Research Professor
- Prof. N. Marikkar, Associate Research Professor
- Dr. R.R. Ratnayake, Senior Research Fellow

Elected by the Research Fellows of National Institute of Fundamental Studies

- Dr. H.W.M.A.C. Wijayasinghe
- Dr. R. Liyanage
- Dr. I.P.L. Jayaratne

Secretary to the Research Council

- Dr. P.S.B. Wanduragala

5. AUDIT & MANAGEMENT COMMITTEE

Committee Members

1. Mr. J.M.U.P. Jayamaha (Chairman)
(Treasury Representative)
Additional Director General
Department of Public Enterprises
Ministry of Finance
2. Prof. Jayantha Wijeyaratne (Board Member)
Senior Professor (Zoology)
Department of Zoology and Environmental Management
University of Kelaniya
3. Prof. C.P. Deepal W. Mathew (Board Member)
Head of Department
Department of Biochemistry and Molecular Biology
Faculty of Medicine
University of Colombo
4. Prof. N.G.J. Dias (Board Member)
Professor in Computer Sciences
Department of Computer Systems Engineering
University of Kelaniya

Secretary to the Committee (Convener)

5. Dr. P. S. B. Wanduragala (Secretary to the Board)
National Institute of Fundamental Studies
Kandy

Observers

6. Mr. S. W. D. N. Wickramasinghe
Audit Superintendent
Government Audit Division
University of Peradeniya
7. Mr. M. C. Gamage
Chief Internal Auditor
Ministry of Science, Technology and Research

By invitation

8. Prof. S. H. P. P. Karunaratne (up to May 2018)
Prof. Saman Seneweera (appointed on 4th June 2018)
Director / CEO / CFO
National Institute of Fundamental Studies
Kandy
9. Mrs. P. S. S. Samarakkody
Accountant
National Institute of Fundamental Studies
Kandy

Assisted by

10. Ms. S. N. Jayasooriya
Mr. Indika Wijesinghe
Internal Audit Officers
National Institute of Fundamental Studies
Kandy

6. DIRECTOR'S REVIEW 2018

During the year 2018, NIFS has seen many changes including the appointment of a new Director and new staff. Currently, we have 19 scientists, 29 Research Assistants and 64 Non- academic and supporting staff at our institute. Our scientists are engaged in cutting edge research and have published 73 papers in international and local journals, attended 30 international and 35 national conferences. They have also attracted funding to the tune of Rs. 32.12 million. Our scientists have formed strong collaborations and networks both nationally and internationally. We currently have collaborations with the state Universities with agendas to set up collaborations with national institutes in the following years through the provision of adjunct professorships to raise our research calibre. We collaborate with many international universities and institutions around the world to share and strengthen research activities.

Over the last four decades, NIFS has trained many MSc and PhD students, with a focus on fostering research and leadership in our young graduate scientists through its six research areas under 6 thematic units and has received recognition nationally and internationally. Currently, we have 100 postgraduate students working on various research areas including theoretical physics, particle chemistry, biotechnology and molecular biology. Through our efforts, we have been able to obtain 3 scholarships from the University of Southern Queensland, Australia to engage in national research based at NIFS.

I am excited to take on the challenge of finding new ways to make this great Institute even better. In particular, I would like to focus on enhancing research collaboration and promoting graduate education. To this effect, we conducted our first ever 3 Minute Thesis presentation for our undergraduate and post graduate students to present their research in layman terms. This was an astounding success and provided a much-needed platform for our young scientists to improve their presentation skills. We also conducted various seminars and workshops to provide a dynamic working and learning environment for our students. The Young Researchers Forum, welfare, entertainment and spiritual programs run by the Welfare Association and the student run magazine have been other ways through which we foster a sense of belonging for our undergraduate and postgraduate students. The purpose of research is not only to explore for new knowledge, but also for dissemination of knowledge. To foster this way of thinking amongst school students, NIFS conducted its 45th School Science Program in August 2018 under the leadership of the Science Education and Dissemination Unit (SEDU). Students who obtained 09 distinctions in their GCE(O/L) examinations from all around the island participated in the program and had the opportunity to listen to presentations by scientists, use state of the art equipment and view the work conducted in our labs.

Our scientists have also regularly written articles in national newspapers and presented interviews in all leading television channels further disseminating their research findings to the wider public. Further, scientists at NIFS also focus on addressing burning national issues like, human animal conflicts, chronic kidney disease, food and nutrient security, water quality etc.

Even though, NIFS gives prominence to basic/fundamental research according to its act, our research work aligns with the UN Sustainable Development Goals.

Achieving sustainable development Goals (SDGs) by UN in Percentage from is given below.

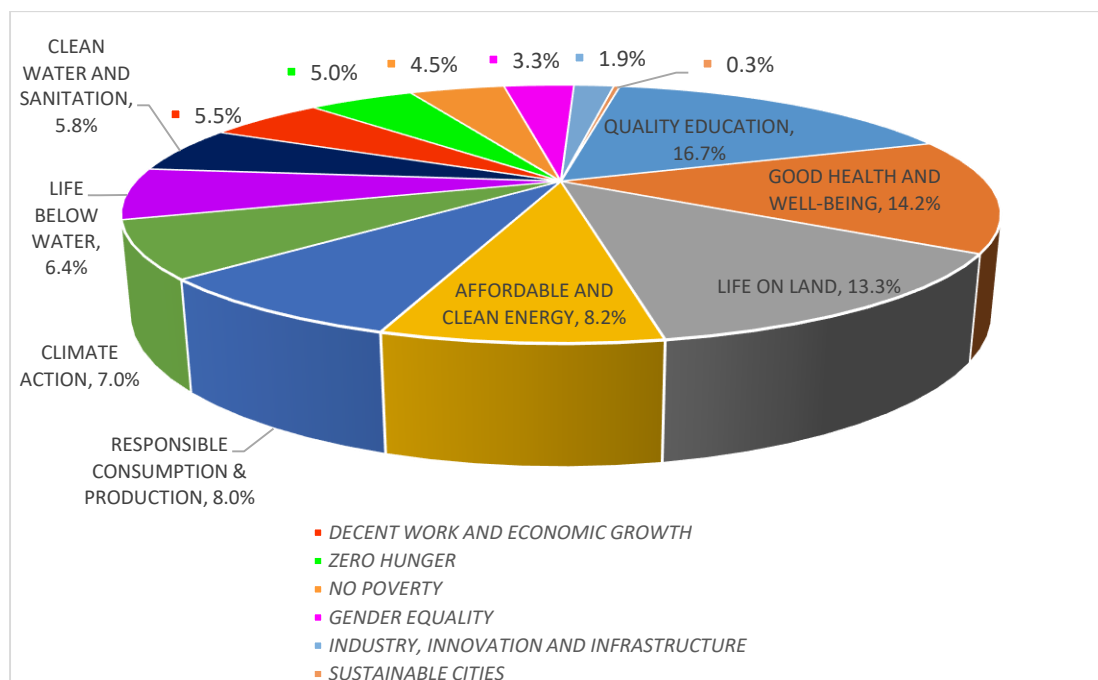


Figure 1. Achieving sustainable development Goals (SDGs) in 2018

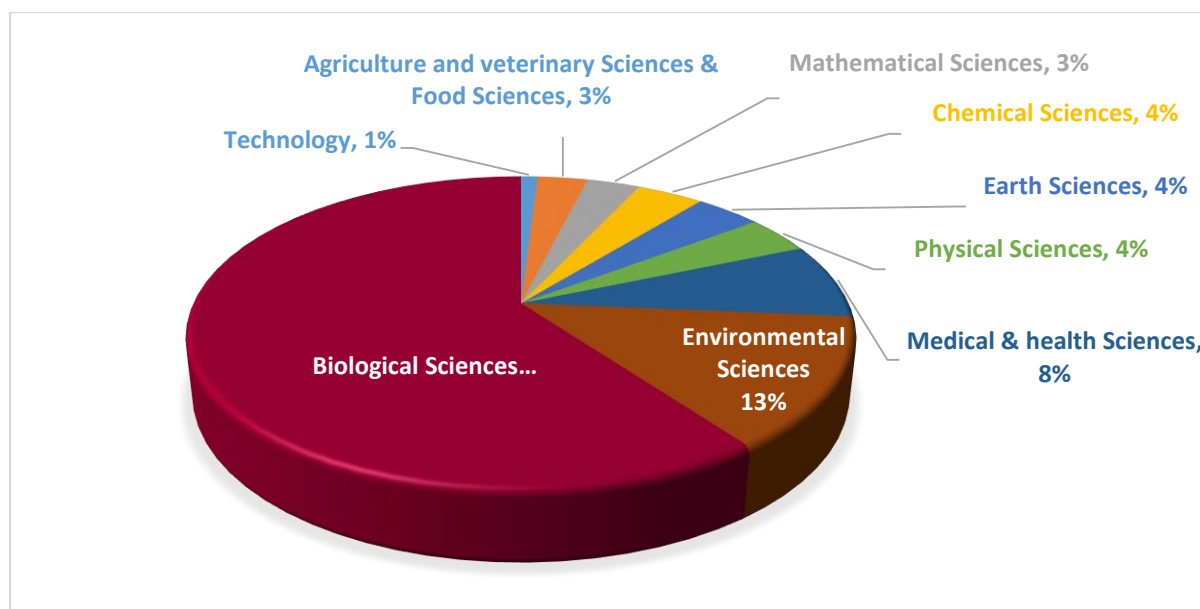


Figure 2. Field of Research areas covered based on UN categorization in 2018

The financial progress of the recurrent and capital expenditure incurred during year 2018 is indicated below. Accordingly, out of recurrent expenditure, 66.6% of total expenditure was made to meet the personal emoluments and the balance was made to meet the other expenses. Out of the capital expenditure, 56.9% was incurred to meet laboratory equipment and balance was expended to meet the other capital expenses.

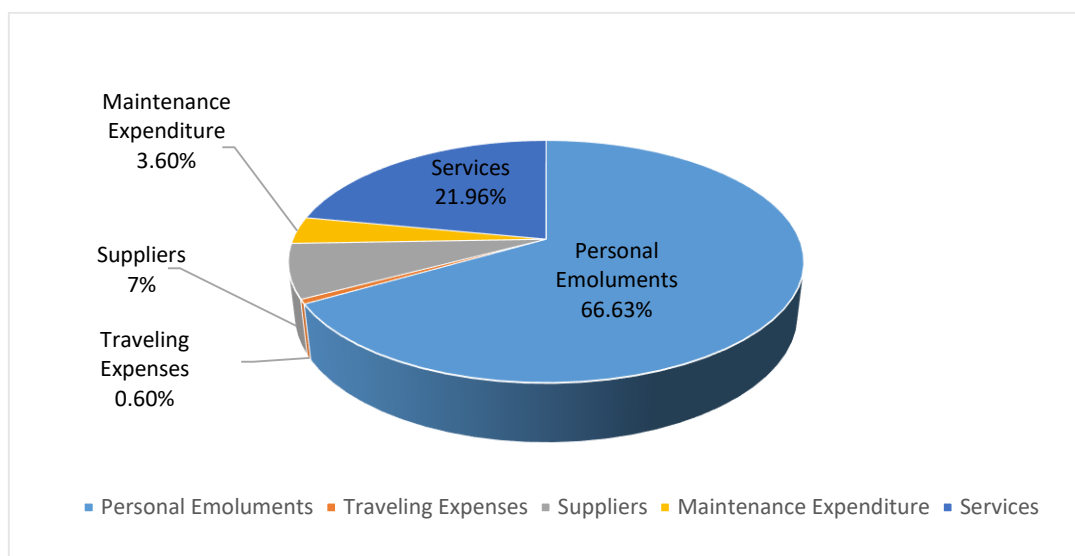


Figure 3. Details of the recurrent expenditure in year 2018

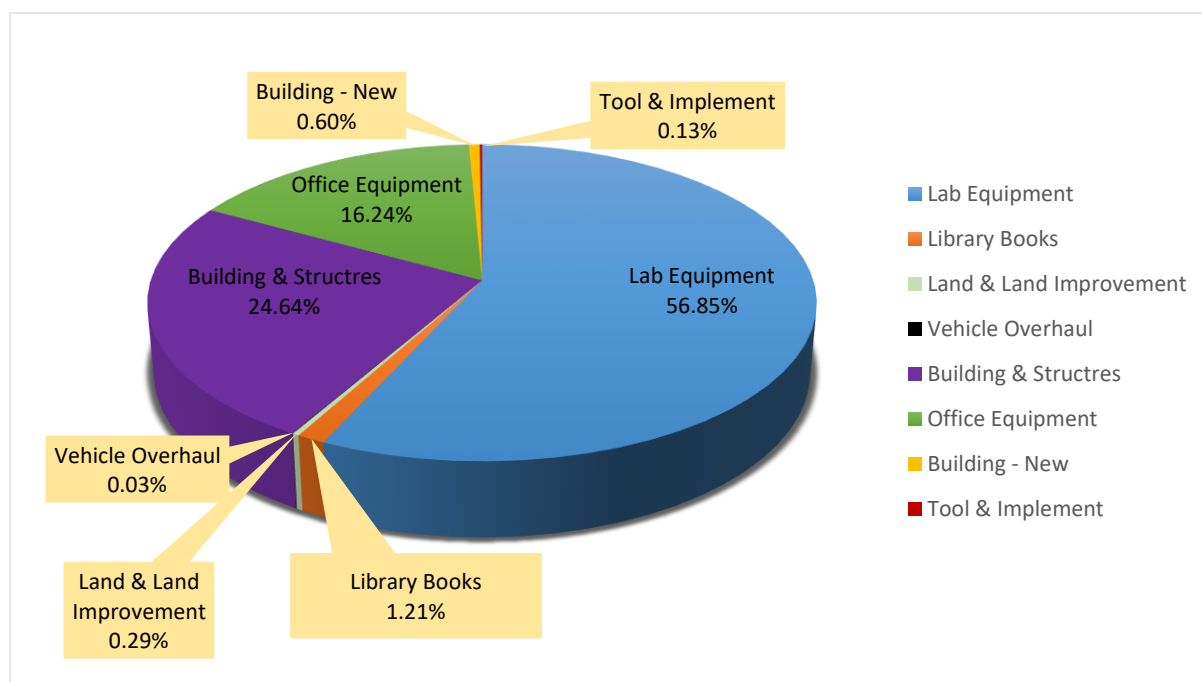


Figure 4. Details of the capital expenditure in year 2018

7. SUMMARY OF THE PERFORMANCES OF INSTITUTE IN YEAR 2018

7.1 Scientific achievements

- For a research institute it is important to publish the research findings in high quality research journals. In year, 2018 we have published articles in;
 - 75 research papers in Science citation indexed (SCI) journals
 - 20 research papers in Science citation expanded (SCI) journals
 - 23 research papers in other refereed journals
- In addition, 20 research articles were published Conference proceedings and 144 scientific abstracts were published. Three books/Monographs & Book Chapters were published as well. Furthermore, 22 articles were published in magazines & newspapers to disseminate the details of the scientific findings to the general public.
- Five Patents were filled and 3 were awarded from the research findings.
- Scientists were capable of attracting funds for their research Grants [15-new grants & 25 on going grants]
- We have 45 research collaborations out of which 13 were initiated in year 2018. Details of the Research collaborations with universities & institutions

Australia

- Queensland University of Technology
- University of New England, Australia
- University of Sydney, Australia

Germany

- Georg-August-Universität Göttingen, Göttingen,

Italy

- University of Parma

Japan

- Shizuoka University, Japan
- Toyota Institute of Technology, Japan

Norway

- Western Norway University

Pakistan

- University of Agriculture, Pakistan
- National University of Medical Sciences Rawalpindi, Pakistan

Sri Lanka

-

- Open University of Sri Lanka, Nawala
- Sabaragamuwa University of Sri Lanka
- South Eastern University of Sri Lanka
- University of Colombo
- University of Jaffna
- University of Kelaniya,
- University of Peradeniya,
- University of Rajarata
- University of Ruhuna
- University of Sri Jayawardenapura
- University of Uva Wellassa

- University of Wayamba
- Atomic Energy Board, Sri Lanka
- Coconut Research Institute, Lunuwila
- Irrigation management division, Irrigation Department
- Mahaweli Authority of Sri Lanka
- National Herbarium, Peradeniya
- NRMC, Department of Agriculture, Peradeniya
- Respiratory disease treatment unit, Teaching hospital, Kandy
- RRD, Batalagoda

Sweden

- Chalmers University

United Kingdom

- University of the West of Scotland
- Natural History Museum, London
- Buckingham Centre for Astrobiology, Buckingham

United State of America

- Georgia State University, USA
- California Polytechnic State University, San Luis Obispo

- Research Supervision enhance the science knowledge hub and this capacity building process save millions of rupees which would have been spent overseas for postgraduate studies.

Degree	completed	in progress
PhD	1	9
MPhil	6	44
MSc	8	12
B Sc research project	17	21

- Details of the awards received by the NIFS staff for year 2018 are given below:

Details of the award	Award	Awarding Institute
National Competitive Award for Life-time Achievement	<i>Prof. Dissanayake, M.A.K.L.</i>	National Science Foundation
Presidential Award for Scientific publications in SCI journals published in 2016 [received on 2018.11.06]	<i>Prof. Bandara, J.M.S., Prof. Dissanayake, M.A.K.L. Prof. Kumara, G.R.A. Prof. Magana-Arachchi, D.N. Dr. Liyanage, R. Ms. Gannoruwa G.M.A.U.K., Ms. Jayathilake R.M.G.C.S.K. Mr. Kumarathilaka S.M.P.R., Ms. Liyanage, H.M. Mr. Manjeevan A. Ms. Visvanathan, R.</i>	National Research Council

Details of the award	Award	Awarding Institute
Merit Award for Scientific Publications-2016, [received on 2018-12-20]	<i>Prof. Benjamin, S.P.</i> <i>Prof. Iqbal, M.C.M.</i> <i>Prof. Jayasinghe, L</i> <i>Mr. Qader M,</i>	National Research Council
National Competitive Award-Annual Research Awards 2017, [received on 2018.11.28]	<i>Prof. Dissanayake, M.A.K.L.</i> <i>Prof. Senadeera, G.K.R.</i>	National Science Foundation
National Competitive Award for Support Scheme for Supervision of Research Degrees -SUSRED AWARDS 2017 [received on 2018-07-25]	<i>Prof. Dissanayake, M.A.K.L.</i> <i>Prof. Kumar, N.S.</i> <i>Prof. Jayasinghe, L</i> <i>Prof. Senadeera, G.K.R.</i> <i>Dr. Wijayasinghe, H.W.M.A.C.</i>	National Science Foundation
NIFS Outstanding Scientists 2017 received on 2018.04.06 1 st place 2 nd Place 3 rd Place	<i>Prof. Dissanayake, M.A.K.L.</i> <i>Prof. Jayasinghe, L</i> <i>Prof. Wijesundara, D.S.A.</i>	National Institute of Fundamental studies
Gold Medal for best thesis presentation at Three Minutes Thesis competition	<i>Ms. Thureirajah A.</i>	National Science Foundation
Merit Award at Young Scientist Forum Symposium	<i>Ms. Thureirajah A.</i>	National Science Foundation
NIFS-Three minutes Thesis Competition (Postgraduate Category): 1 st place 2 nd Place 3 rd Place	<i>Ms. Sathya S.</i> <i>Ms. Weerasinghe, M.A.Y.N.</i> <i>Ms. Jayasekara S.</i>	National Institute of Fundamental studies
NIFS-Three minutes Thesis Competition (Undergraduate Category): 1 st place 2 nd Place 3 rd Place	<i>Mr. Dissanayake P.N.</i> <i>Ms. Madamarandawala J.M.P.S.</i> <i>Ms. Bowange T.</i>	

7.2 Progress of Research Projects

7.2.1. Bioenergy & Soil Ecosystems research project

Project Leader –Dr. Renuka Ratnayake

Introduction to Research Project

Bioenergy and Soil Ecosystems are the main areas under investigation. This Soil Ecosystems research project targets to determine soil C sequestration potential, its dynamics and the method of improvement in different major vegetation types of Sri Lanka such as natural and plantation forests, wetlands, agricultural plantations, farm lands, home gardens and small holder cultivations etc. Estimation and mapping of C storage capacity of paddy soils is under investigation. The coastal blue carbon ecosystems of Sri Lanka are under investigation for the potentiality of capturing and storing carbon. The aim of the Bioenergy research project is to explore the microbial flora of Sri Lanka for cellulase production and their applications. Other than biofuel the microbial cellulases have shown potential application in a wide range of industries including pulp and paper, textile, laundry, food and feed industry, agriculture etc. The present project focused on studying the potential applications of enzyme extracts obtained from locally isolated cellulolytic microorganisms in different value-added products and processes.

Activities carried out during the year

The following experiments were conducted:

- Development of baseline soil information system for soil C and other nutrients for paddy growing soils in Sri Lanka
- Estimation and Mapping of Carbon Storage Capacity of Coastal Blue C Ecosystems of Sri Lanka
- Determination of nitrogen use efficiency of paddy
- Microbial cellulases: The application in Biofuel production and other value added products and processes
- Investigation of genetic diversity of cyanobacteria in different water bodies of Sri Lanka with their taxonomical identification, nutrient profiling and toxin analysis
- Isolation of Denitrifying Bacteria and their Potential use in Nitrate Removal of Well water of Jaffna District

7.2.2. Condensed Matter Physics & Solid State Chemistry research project

Project Leader – Prof. M.A.K. Lakshman Dissanayake

Introduction to Research Project

During 2018, Condensed Matter Physics & Solid State Chemistry (CMP+SSC) project at NIFS focused on the synthesis and characterization of technologically important novel solid state and quasi-solid state (gel) materials and in particular on developing novel materials and devices for energy generation and utilization. During the year, the group has carried out several projects, (a) Plasmon enhanced, PbS:Hg quantum dot sensitized solar cells with triple layer TiO₂ photoanode, (b) High efficiency plasmonic dye-sensitized solar cells with silver nanowires and TiO₂ nanofibres incorporated multi-layered photoanode, (c) Characterization of poly (vinylidene fluoride-co-hexafluoropropylene)(PVdF-HFP) nanofiber membrane based quasi solid electrolytes and their application in dye sensitized solar cells and (d) Efficiency enhancement in dye sensitized solar cells fabricated with AlCl₃ treated, SnO₂ based nanoparticle/nanofibre/nanoparticle triple layered photoanode.

A: Plasmon enhanced, PbS:Hg quantum dot sensitized solar cells with triple layer TiO₂ photoanode

Quantum dot-sensitized solar cells (QDSCs) have attracted extensive attention recently and become promising candidates for the cost – efficient energy conversion applications due to the unique optical and electrical properties of semiconductor quantum dots. Plasmonic gold nanoparticle incorporated Hg – doped PbS quantum dot-sensitized solar cells (QDSSCs) were fabricated using successive ionic layer adsorption and reaction (SILAR) method with TiO₂ triple layer photoanode nanostructures and characterized by optical and electrical characterization techniques. This nanostructure was fabricated by using a TiO₂ nanofibre (NF) layer sandwiched between two TiO₂ nanoparticle (NP) layers in order to enhance light harvesting through effective light scattering process. Plasmonic enhanced QDSSC showed a better efficiency of 5.41 % with an open-circuit voltage of 679.8 mV and a short-circuit current density of 18.02 mA cm⁻².

B. High efficiency plasmonic dye-sensitized solar cells with silver nanowires and TiO₂ nanofibres incorporated multi-layered photoanode

The effect of incorporating silver nanowires (Ag NWs) and TiO₂ nanofibers (NFs) into a tri-layer photoanode of dye sensitized solar cells (DSSCs) have been investigated. Ag NWs with diameter 60-90 nm and length of 1-2 µm were synthesized via polyol reduction method. TiO₂ nanofibers (NFs) with diameter 80-120 nm were prepared by electrospinning. The DSSC with tri-layer photoanode made with a composite of TiO₂ P25, Ag NWs and TiO₂ NFs sandwiched between two TiO₂ P25 layers exhibited power conversion efficiency of 9.74% and open circuit voltage (V_{oc}), short circuit current density (J_{sc}) and fill factor (FF) of 727.4 mV, 19.8 mA cm⁻² and 67.6% respectively under the irradiance of 100 mW cm⁻². The efficiency of the reference DSSC with TiO₂ P25/P25/P25 tri-layer photoanode of the same thickness was found to be 6.69%.

C: Characterization of poly (vinylidene fluoride-co-hexafluoropropylene)(PVdF-HFP) nanofiber membrane based quasi solid electrolytes and their application in dye sensitized solar cells

The electrolyte plays a major role in dye sensitized solar cells (DSSCs). In this work a quasi-solid state (gel) electrolyte has been formed by incorporating a liquid electrolyte made with KI dissolved in ethylene carbonate (EC) and propylene carbonate (PC) co-solvent in poly (vinylidene fluoride-hexafluoropropylene) (PVdF-HFP) co-polymer nanofiber membrane prepared by electrospinning. SEM images of the electrolyte membrane showed the formation of a three-dimensional network of polymer nanofibers with diameters between 100-300 nm and an average membrane thickness of 14 µm. The electrolyte was characterized by FTIR and differential scanning calorimetry (DSC) measurements and the DSSCs fabricated with this electrolyte were characterized by J - V and EIS measurements. DSC thermograms revealed that the crystallinity of the PVdF-HFP nanofiber is 14% lower than that of the pure PVdF-HFP polymer while the FTIR spectra showed a reduced polymer-polymer interaction in the nano fiber based gel electrolyte.

D: Efficiency enhancement in dye sensitized solar cells fabricated with AlCl₃ treated, SnO₂ based nanoparticle/nanofibre/nanoparticle triple layered photoanode

The use of electrospun nanofibres of SnO₂ in triple layered photoanode with AlCl₃ treatments towards the efficiency enhancement in dye sensitized solar cells (DSSC) is

revealed. More than five fold enhancement in overall conversion efficiency can be achieved by incorporation of this novel photoanode in SnO_2 based DSSCs with the optimized thickness of the nanofibre layer. Interconnected network type structure of SnO_2 nanofibres is observed with scanning electron microscopy (SEM). Enhanced light scattering due to the incorporation of nanofibre layer in the photoanode might be the major reason for this efficiency enhancement as reflected from the increment in the photo current density. EIS measurements on both the conventional and novel photoanode reveals that, the series resistance of the DSSC can be reduced by employing this triple layered photoanode in these DSSCs. The observed higher electron lifetime from Bode plots revealed that electron recombination is lower in the DSSCs with this novel photoanode. Under the irradiance of 100 mW cm^{-2} (AM 1.5), DSSCs fabricated with the conventional nanoparticle single layered photoanodes sensitized by Indoline and Eosin-Y dyes showed 0.3% and 2.02% efficiencies respectively, while devices with triple layered photoanodes respectively showed 1.55% and 2.73% efficiencies under the same conditions.

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List of Developed Solutions to address current issues in the country:

Four different types of solar cells have been developed. These have the potential to be further developed as a low-cost option to replace much more expensive silicon solar cells/panels in today's market, thereby increasing the renewable energy contribution to Sri Lanka's energy

7.2.3. Earth Resources and Renewable Energy research project

Project Leader- Prof. N.D. Subasinghe

Energy is one of the single most important entities of the mankind today. With the ever-increasing demand, efficient use of existing energy sources is as important as finding new sources of energy. ER & RE project focuses on both of these aspects. This concept has also been extended to other earth resources such as mineral resources.

Sub project on geothermal resources of Sri Lanka has both fundamental and applied aims. While there is no question about the usefulness of finding geothermal energy as a renewable energy source, there is also a strong academic interest to understand the origin of geothermal resources in Sri Lanka and its relationship to the Highland-Vijayan lithological boundary.

Sri Lanka is rich in minerals with economic value. Sustainable utilization of known deposits as well as finding hitherto unknown mineral deposits will contribute to the economic development of the country. Deep understanding of the origin of minerals and rocks in Sri Lanka will not only help to identify new resources, but also will help to understand the origins of lithological complexes in Sri Lanka and contribute to the advanced knowledge.

A project on radon mapping is conducted jointly with the Atomic Energy Board, Sri Lanka to establish the baseline of the background radiation levels and to find mineral resources.

The project on thermoelectricity is a pioneering research area introduced to Sri Lanka. Thermoelectricity is the generation of electricity directly from heat energy using “*Seebeck Effect*”. While thermoelectricity can generate electricity using renewable sources, one of the major advantages of it is the unique ability to increase the overall efficiency of an existing system by ‘scavenging’ and converting waste heat to electricity through co-generation.

7.2.4. Energy & Advanced Material Chemistry research project

Project Leader – J. Bandara

Introduction to Research Project

The main objective of the Energy & Advanced Material Chemistry project is to carry out research on renewable energy and specifically our research is mainly focused on chemistry and physics of new materials for the conversion of solar energy into chemical and electrical energies. Under the broad theme of solar energy conversion into useful energy, the project has several sub-projects such as photocatalysis/catalysis, solar cell and environment remediation. In the photocatalysis project, we construct artificial chemical devices mimicking photosynthesis to collect, direct, and apply solar radiation, for example to split water, convert atmospheric carbon dioxide and thus produce various forms of environmentally clean fuels. Our research is mainly focused on the production of hydrogen by water splitting reaction where hydrogen is considered to be the future energy source. Additionally, the group is actively carrying out research on environment remediation where we investigate novel low-cost water and air purification methods for abatement of industrial pollutants by using sunlight. In the research topics of conversion of solar energy into electrical energy, our research is mainly focused on the understanding and improvement of fundamental requirements (efficient harvesting of sun light and efficient separation of excited charge carriers) of different types of solar cells such as dye-sensitized, polymer and q-dot sensitized solar cells.

Activities carried out during the year

Harvesting of waste energy is one of the most promising technologies to address the contemporary energy shortage. The basic concept in waste energy harvesting technology is the conversion of waste energy such as heat, vibrational energy and mechanical energy into useable form of energy such as electrical energy or chemical energy. Recently, there is a keen interest on the use of piezoelectric materials in harvesting the waste energy and the use of the piezoelectric properties of piezoelectric materials is a very promising source of alternative energy harvesting method. Potassium niobate (KNbO_3) and sodium niobate (NaNbO_3) gained much interest in piezoelectric materials in harvesting waste energy especially in piezotronic devices. Despite their excellent piezoelectric properties, the piezocatalytic activity of KNbO_3 is found to be poor. The piezocatalytic process can be enhanced through regulating the concentration of charge carriers by using narrow band gap

semiconductors or defect doping. In this investigation, we synthesized the piezoelectric KNbO_3 by modified solid-state reaction and enhanced the free charge carrier in piezoelectric KNbO_3 by introducing a large number of oxygen vacancies and demonstrated the excellent piezocatalytic activity of KNbO_3 by harnessing waste energy to produce H_2 .

Thin-film solar cells technology is one of the solutions for expensive silicon solar cells. The kesterite-structured $\text{Cu}_2\text{ZnSnS}_4$ (CZTS) semiconductor has been considered as a promising light-harvesting material and a great progress on CZTS based solar cells has been achieved during the past few years. For the fabrication of CZTS solar cells, vacuum and non-vacuum deposition techniques have been reported. Among these methods, non-vacuum techniques such as spray pyrolysis, spin coating, and electrodeposition are widely being used owing to their simplicity and the low cost. In this study, CZTS thin films were prepared on Fluorine doped tin oxide (FTO) by spray pyrolysis, spin coating, and electrodeposition methods and their properties were compared.

List of Developed Solutions to address current issues in the country

Under the NSF technical grant, we have developed a mini-reactor system to separate waste oil from the service station wastewater. The reactor will be scaled up and tested in service stations.

7.2.5. Environmental Science Research Programme

A. NIFS Water Research Project

Project Leader – Professor Rohan Weerasooriya

Introduction to Research Project

The NIFS Water Research Project aligns with the UN Sustainable Development Goal Six- Clean Water and Sanitation by 2030. Sri Lanka is not a water scarce nation! However, over 14% of the population (~3 million) in the dry zone does not have safe palatable water sources due to high salinity. We will provide a total solution for water stress in the dry zone introducing a treatment method with zero wastes. Performance of conventional sand filters will enhance. Tunable nano membranes will develop from Sri Lankan Graphite. An integrated water quality index will introduce for source water demarcation using chemical species of primary contaminants by in situ experimental methods. Scientists of National Water Supply Drainage Board, University of Peradeniya, University of Jayawardhanapura and Rajarata University collaborate with NIFS.

Activities carried out during the year

We designed a new water treatment facility to be used in dry zone villages. The model water treatment plant is now operational at Rajarata University of Sri Lanka. The aim of this activity is to provide robust water treatment to a village. The optimization of the unit is completed. Within five years period, the technology will be transferred to Sri Lanka, and most of the consumables will be fabricated from indigenous materials. Dominant water quality issues in Sri Lanka dry zone groundwater are high TDS, hardness and fluoride that often exceed regulatory safety limits. Since the fluoride is a primary contaminant control that level before consumption is mandatory. Even though, both TDS and hardness regulation is not mandatory; they are seriously

imparting water palatability. Therefore, water palatability requires improved before treating fluoride or other minor constituents. Water treatment based on reverse osmosis technology is a widely used treatment method in the dry zone. We proposed an integrated water quality index (IWQI) utilizing chemical species for rapid demarcation of source water selecting a village in the dry zone. The IWQI values ranged from 9 - 406, and they were categorized into five classes (very good 0 – 25, good 26 – 50, poor 51 – 75, very poor 76 – 100, and unsuitable > 100). IWQI values were classified by cluster analysis.

List of Developed Solutions to address current issues in the country, if any

1. Development of membrane base water treatment facility suited to dry zone
2. Development of integrated index for rapid screening for treatment
3. Development of super-sand water treatment unit process

B. Materials development & pollution remediation

Project Leader – Dr. Lakmal Jayarathna

Introduction to Research Project

Environmental Science research program has been considered as an area of both basic and applied science. However, at NIFS it takes a different perspective in setting up environmental research programs. In essence the **NIFS Environmental Science Research Program** focused on addressing the fundamental scientific aspects of pressing environmental problems in Sri Lanka with global interest. Environmental pollution is one of the major results of modern development. Remediation of pollutant materials from water, soil and air is the most focused. Monitoring and understanding of the basic and fundamental mechanisms of the pollutant materials in nature is much more important. Advanced materials such as nanomaterials and composite materials play vital role in various applications.

Activities carried out during the year

Activity I

Synthesis of L-Cysteine capped CdTe quantum dots for detection of pollutants in environment

Activity II

Synthesis of zeolite and nano-zeolite from local kaolin clay and other materials for membrane development to remediation of water hardness, gas adsorption

Activity III

Iron oxide and modified nanomaterials for remediation of pollutants in water

Activity IV

Iron Oxide coated super-sand for fluoride removal in water

Significant scientific research findings and inventions during 2018:

- Development of novel, low cost method for synthesis of L-Cysteine capped CdTe quantum dots in atmospheric conditions in zeolite facilitated media.
- Synthesis of nano zeolite-A (LTA Zeolites) with aid of Sodium dodecyl sulfate (SDS) as particle size-controlling Agent.
- Synthesis of zeolite-A using locally available kaolin clay
- Fabrication of super-sand

C. Air Pollution & Risk assessment

Project Leader- Dr. G. Bowatte

Air pollution is a global public health issue. Annually about 7 million people die from air pollution exposure. It is the top environmental risk factor associated with burden of disease. In Sri Lanka, air pollution exposure is a neglected health risk for humans. Air pollution is ubiquitous and whole population in a given areas is exposed. Therefore, even small increase may pose a high risk at the population level. Exposure to air pollution leads to development and exacerbations of respiratory and cardiovascular diseases. The health burden pose on Sri Lankan economy by air pollution has significant consequences by affecting economic growth as well as welfare.

Air pollution modelling is used to estimate population/individual level exposures which are important in health risk assessments. Research project at the “Air Pollution Modelling and Health Risk Assessment” group aimed at modelling air pollution in Sri Lankan urban and rural areas, estimating health risk associated with air pollution and evaluating performance of air pollution control methods. Hence, the information generated can be utilized to identify vulnerable groups, high risk areas, provide recommendations to implement policies to reduce pollution. The research of this group will provide evidence targeted at controlling air pollution by implementing policies.

7.2.6. Evolution, Ecology & Environmental Biology research project

Project Leader - Prof. Suresh P. Benjamin

Studies in my lab are currently on plants and animals in terrestrial and freshwater ecosystems worldwide, with a special focus on the Western Ghats-Sri Lanka biodiversity hotspot. The primary focus, however, is the largely uncharted fields of invertebrate and small plant biodiversity. The invertebrate fauna of our country remains largely unexplored, with most studies originating during the colonial period.

Activities carried out during the year

- Molecular Phylogeny of Goblin Spiders with a Revision of Selected Genera (Araneae: Oonopidae) of Sri Lanka
- Molecular Phylogeny and Systematics of Jumping spiders (Araneae: Salticidae) from Sri Lanka

7.2.7. Food Chemistry research project

Project Leader – Prof. Nazrim Marikkar

Introduction to Research Project

Food chemistry project at NIFS focuses on exploring the application of food chemistry to add values to the under-utilized plant resources to address the national food security. Food security is a problem of national importance for Sri Lanka in the context of challenges arising from climate change. In this backdrop, adding values to the underutilized resources could be a good strategy. Sri Lanka as a tropical country with a rich biodiversity has got several underutilized plant resources; some of them are edible plants, fruits, seeds etc. in the wild forest. In the agricultural sector of the country, there are several byproducts, which are wasted or underutilized due to lack of research on commercial exploitation. However, through systematic studies, these

byproducts can be added values to formulate novel food products or ingredients. These novel products formulated through value addition not only can serve the purpose to address the food and nutritional needs of the society but also can serve as functional foods to mitigate the risk of developing chronic diseases such as diabetes. We investigate nutritional composition, bioactivities, keeping quality and functional properties of raw materials coming from these under-utilized plant resources. Generally, the nutritional composition, bioactivities, and functional properties of raw food items might undergo changes by the application of different food processing methods such as freezing, thawing, drying, frying, etc. Research studies about these changes are of considerable importance for human nutrition, food safety and wellness. As a part of the project, we also focus our attention to the application of food chemistry to ensure the quality and authenticity of food product to safeguard consumers from fraudulent practices.

Activities carried out during the year

Publications with International publishers, Signing MOU with Coconut Research Institute, Lunuwila, Postgraduate research supervision, Undergraduate research supervision, Seminar presentations at outside institutions

7.2.8. Material Processing & Device Fabrication research project

Project Leader – G. R. A. Kumara

Introduction to Research Project

Project deals with the conversion of locally available carbon materials into value-added products and utilize them for device application. Purification of Sri Lankan graphite, exfoliation into expanded forms, graphene and graphene oxide are intended themes. Attempts will be made to find innovative ways of adopting them in energy conversion and storage systems notably solar cells and supercapacitors. At present commercial supercapacitor electrodes are made of coconut charcoal and graphite two materials readily available in Sri Lanka. Work involves resolution of fundamental issues as well as development of cost-effective techniques. Merits of the investigation are contribution to clean energy effort, value addition to local raw materials, device innovations, and motivation of students. Apart from above specialties, other activities falling into the broader theme of the project will be attempted.

Activities carried out during the year

During the year, the project succeeded in achieving the following contributions to the theme of the project. Graphite purification and exfoliation work has been continued and the exfoliated material was examined for oil absorption and fabrication of supercapacitor electrodes. New technique was developed for purification and activation of coconut charcoal. Binder free supercapacitor electrodes were studied and found to yield capacitor values comparable with state-of-art standard commercial devices. A highlight of this work is innovative design of entirely carbon, high electrical conductivity and hard supercapacitor electrodes plates, constituted of coconut charcoal and pyrolyzed sugar. These electrodes are found to be alkali and acid resistant and undergo no thermal disorganization, unlike binder-based electrodes. For academic reasons, a search was also made for new binder materials and Jack Fruit Latex was found to be an environmentally friendly binder for coconut charcoal granules. Work on solar cells was also continued. Institute of Fundamental Studies pioneered the development of the dye-sensitized solid-state and extremely thin absorber solar cells and development of their crucial component known as the hole-collector.

Studies conducted elsewhere now indicate, the material CuSCN first studied in Sri Lanka for this application, super-pass alternatives identified subsequently. Motivated by these findings, the project revived investigations and found ways improving the p-type conductivity of CuSCN.

7.2.9. Microbial Biotechnology research project

Project Leader – Prof. Gamini Seneviratne

Introduction to Research Project

The research program focuses on investigations of the role of developed microbial biofilms in agriculture, plantations and the environment. With the invention of development of microbial biofilms [fungal-bacterial biofilms (FBBs) in particular] in vitro in 2002, several basic research studies were conducted to evaluate their potential as microbial ameliorators in the soil and also in the environment. The studies yielded very promising results. Consequently, biofilm-based biofertilizers called Biofilm biofertilizers (BFBFs) were developed for agriculture and plantation crops (especially non-legumes, e.g. tea, rice, vegetables etc.), tested extensively under field conditions, and were commercialized in 2014. So far, BFBFs have been used over 30,000 acres in the country with a chemical fertilizers (NPK) cut down up to 50%, while increasing crop yields between 10-40%. It is also used in organic agriculture. Researches on BFBFs have also been started in Canada, India, Indonesia, Brazil and Iraq.

Activities carried out during the year

There are no studies carried out to evaluate BFBF in rice with special reference to endophytic diazotrophs (EDs) that are important in biological nitrogen fixation etc. and crop production. Therefore, a study was designed to evaluate the effect of BFBF practice on EDs and grain yield by analysing soil, plant and microbial parameters in 12 farmers' real paddy fields (1 - 2.5 acres *Liyaddas*) in Yala season (2018) in Polonnaruwa district. Results indicated that there was a significant contribution of the BFBF practice to increase grain yields over farmers' normal chemical fertilizers practice, which was directly linked to the increased EDs in the BFBF practice. This clearly showed the importance of microbial interventions, if we are to increase future rice production in the country.

In agro-ecosystems, microbial communities are affected by farmers' practices (e.g. excessive use of chemical fertilizers, CF), disrupting its natural cycles through depleting beneficial microorganisms. BFBF application to a crop soil increases N₂ fixing bacteria, P-solubilizing fungi and many other useful microorganisms which help reinstate the degraded networks in the agro-ecosystem by replacing lost organisms and also producing various biochemicals such as phytohormones, signaling molecules, etc. Thus, the present study was designed for analyzing soil, plant and microbial parameters with the application of farmers' CF practice and BFBF practice in 25 different locations using rice (*Oryza sativa* L.) as the test crop, and to reveal the effect of BFBF in re-establishing networks in the agro-ecosystem. Results indicated that BFBF application improved rhizosphere soil organic matter through microbial action via a network interaction, which in turn increased rice grain yield over CF alone application in the farmers' practice.

List of Developed Solutions to address current issues in the country:

During 2018, BFBFs were commercially applied to ca. 3,500 acres of rice cultivation in the country, replacing ca. 50% of chemical fertilizers NPK. Once expanded further, this biotechnology will contribute to mitigate economic, agricultural, human health and environmental issues in the country.

7.2.10. Molecular Microbiology & Human Diseases research project

Project Leader – Prof. D. N. Magana-Arachchi

Introduction to Research Project

Research interests of our lab revolve around microbes and human diseases. Microbes are fascinating creatures and we are interested about the behavior of these microscopic organisms as they have the potential either to be beneficial or harmful to mankind. We try to understand the distribution of microbial communities in environment; air, water and soil as well as within the human lung. The study of human diseases includes both communicable and non-communicable diseases namely pulmonary diseases focusing on drug-resistant tuberculosis (TB) and chronic kidney disease of unknown etiology (CKDu).

Activities carried out during the year

The project focused on three main activities for the year 2018: Research, Human Resource Development and Science dissemination. Both Basic & applied Research were carried out in four areas of interest. In the area of TB & other pulmonary diseases, we continued the study on, role of lung microbiome in lung cancer and bronchiectasis patients while in TB research a collaborative research was started with Pakistan on Genetic characterization of drug resistance *Mycobacterium tuberculosis* isolates. In the area of assessment of airborne microorganisms in outdoor & indoor environments, the research on indoor airborne bacterial study at Kandy hospital was completed and the sub project on airborne microorganisms and respiratory infections among pre-school children is ongoing. Third area of research is zoonotic diseases and a study was started on potential pathogenic bacteria from wild bird droppings around the Kandy Lake, Central Sri Lanka. Fourth area of interest is the screening of microorganisms for potential biotechnological applications, and we commenced studies on the diversity and distribution of thermophilic microorganisms in hot springs of Sri Lanka.

During 2018, research supervision included a PhD student, three M.Phil. students, one MSc student and three undergraduates. We disseminated the findings through publications, participation in workshops, etc

Research on lung microbiome studies found that bacterial diversity was high in two disease groups, about 255 species for lung cancer and 236 bacterial species in bronchiectasis patients in comparison to 140 bacterial species in healthy people. The two organisms *Corynebacterium tuberculostearicum* and *Keratinibaculum paraultunense* were only observed in the disease lung cancer while bronchiectasis did not have specific bacteria limited to them.

The research activities resulted in one M.Phil. degree and one MSc, in addition to three peer reviewed publications and 12 abstracts.

7.2.11. Nanotechnology & Advanced Materials research project

Project Leader – Dr. A. Wijayasinghe

Introduction to Research Project

The Nanotechnology and Advanced Materials project involves with target oriented fundamental and advanced scientific investigations leading to develop Sri Lankan minerals and related materials for nano-technological and advanced industrial applications, such as energy storage, water purification, synthesis of nano-materials and highly upgraded raw materials for high-tech industrial applications

Activities carried out during the year

In 2018, three Sri Lankan Patents were granted based on work carried out by this project on the Development of Sri Lankan graphite for re-chargeable battery application. Further, the establishing of the “National Battery material testing laboratory” at NIFS has been carried out with the funds received under the Research and Development grant for the “Development of Sri Lankan graphite for rechargeable batteries”

7.2.12. Natural Products research project

Project Leader – Prof. U.L.B. Jayasinghe

Introduction to Research Project (Times New Roman 11)

The overall objective of the Natural Products Project of the NIFS is the identification of bioactive extracts and compounds from natural sources, as potential resources for control of human and plant diseases. Research activities have been focused on the chemistry and bioactivity of secondary metabolites from plants, fungi (including endophytic fungi) and edible fruits of Sri Lanka. Another areas of research have been the identification of polyphenols found in tea, medicinal plants, edible fruits and spices using Liquid Chromatography – Mass Spectrometry (LC-MS) and studies on postharvest diseases and disorders of fruit crops, including mango var. Tom EJC that is established in the export market and their management. The disorders studied were fruit pitting, lenticel browning and Internal Pulp Browning which had not previously been reported. These research activities are very wide and represent basic research on the field of natural products chemistry, pharmaceutical research and new materials.

Activities carried out during the year

Project of the NIFS are mainly on the following four areas.

- (1) Investigation of extracts from plant sources and, epiphytic and endophytic fungi, for use in agriculture and human health
- (2) Chemistry and bioactivity of edible fruits
- (3) Plant secondary metabolites and LC-MS profiling of bioactive extracts
- (4) Study of postharvest diseases and disorders of exportable fruit crops and their management

Chemistry & bioactivity of metabolites of fungi associated with medicinal plants, edible fruits: Currently we study the chemistry and bioactivity of secondary metabolites produced *in vitro* by endophytic fungi isolated and identified from some

medicinal plants. Several secondary metabolites with interesting structural features and some useful bioactivities have been isolated and identified.

Enzyme inhibitors from plants: Methanol extract of *Trigonella foenum-graecum* (local name: uluhal) seeds furnished three flavone C-glycosides having pancreatic lipase inhibitory activity. Structures of these compounds were established as vicienin-1, isoschaftoside and schaftoside. This is the first report of the isolation of lipase inhibitors from *T. foenum-graecum* seeds. Compounds showing antioxidant activity, α -glucosidase, and acetylcholinesterase inhibitory activity were isolated from the aril of *Myristica fragrans* (local name: Sadikka).

Overall performance of the Project

List of Developed Solutions to address current issues in the country, if any

- Continuation of exploring biologically active extracts/compounds from Sri Lankan plants and fungal flora,
- Human Resource Development in the field of Natural Products Chemistry. Four postgraduate students, working on natural products research project, are about to complete their theses for Ph.D. (01) and M.Phil. (03) degree.

7.2.13. Nutritional Biochemistry research project

Project Leader –Dr. Ruvini Liyanage

Introduction to Research Project

Nutritional Biochemistry project focuses on various aspects of functional and nutritional properties of foods and cover a wide area like functional and nutritional properties of food, bioavailability, food safety and functional food product development to improve health and well-being of people.

Activities carried out during the year

Conducted research on following topics

- Determination of anti-diabetes properties and chemical constituents of commonly used medicinal plants in Sri Lanka
- *In vitro* digestion, fermentation and physicochemical properties of commonly consumed processed legumes in Sri Lanka
- Physiological, morphological and functional characteristics of commonly consumed starches in Sri Lanka

Two MPhils and one MSc were completed. Several undergraduate students conducted their final year project.

List of Developed Solutions to address current issues in the country

All the above studies were conducted to find solutions for non-communicable diseases in Sri Lanka. Findings are useful to validate the health benefits and bioactive properties of Ayurvedic plants and to identify most suitable starch sources for diabetes.

7.2.14. Plant & Environmental Sciences research project

Project Leader –Prof. M.C.M. Iqbal

The major focus of this group is on environmental remediation of hazardous materials polluting our waterways, particularly by heavy metals, textile dyes, fertilizers (nitrates, phosphates) and toxic organic and inorganic wastes. A cost-effective simple decontamination method is needed for small and medium scale enterprises who are unable to invest in high tech expensive waste water treatment systems. Bio-adsorbents were developed from polymers extracted from seaweeds (alginate) and crustacean shells (chitosan) and combined with kaolin clay to form Polymer layer silicate composites (PLS). The PLS adsorbed with 90% efficiency heavy metals and textile dyes and colour from effluents of textile factories. PLS from alginate and the mineral materials feldspar and kaolin showed a removal efficiency of over 80% for phosphates; however, the efficiency of nitrate removal was moderate (~50%). Hence, aquatic weeds were used for phytoremediation of nitrate.

The plant tissue culture project is investigating the micro-propagation of selected species from the dry forests for restoration of degraded forests. Natural propagation through seeds is seasonal, and seedlings are usually unavailable when required. Thus for large scale propagation traditional methods are inefficient and plant tissue culture can mass propagate species once the protocol is developed.

In Sri Lanka, climate change is manifested by extreme weather as floods and droughts. Since this has immediate implications in our agriculture and health sectors, understanding the historical trends in our rainfall and temperature patterns, particularly extreme weather events, is important to assess future trends. We also looked at socio-economic parameters and climate to combat the spread of the dengue virus, particularly knowledge, attitude and practices (KAP) in high risk areas in the Kandy district. A cross-sectional survey was conducted in five selected dengue free communities living in high risk areas.

7.2.15. Plant Stress Biology & Molecular Genetics research project

Project Leader –Prof. S. Seneweera

Climate change together with biotic and abiotic factors threaten food production globally. The primary reason for such negative responses is the inability of plants to adapt to these stresses. However, these responses are largely varied between species, and even within the same species depending on the magnitude of the environmental stresses. Plant stress tolerance is a complex phenomenon involving multiple gene products of which interact in complex ways to facilitate stress tolerance from subcellular to the whole plant level. A fundamental understanding of these responses is essential to develop high yielding crops having climate insensitivity.

Most of the world's population depend on C3 grains and legumes as their primary dietary source of micronutrients and proteins. Therefore, they are more vulnerable to climate change. Recently, it has been recognised that dietary deficiencies of protein, zinc and iron are a substantial global public health problem which is exacerbated by climate change. Across the globe, an estimated two billion people suffer from these deficiencies, causing a loss of 63 million life-years annually. Further, a large degree of micro nutrients malnutrition has been

recognised in Sri Lanka and is also associated with a number of metabolic diseases. This human catastrophe can only be avoided by improving the nutrient status of cereals and pulses.

The aim of our research is to gain a comprehensive understanding of the mechanisms of climate stress tolerance in plants in order to make informed decisions as to what is required to improve the stress tolerance levels of crops. Thus, molecular characterization of key changes associated with stress is followed using an “omics” approach in which high-throughput technologies are used for identification of transcripts, proteins and metabolites associated with stress tolerance. Biochemical, biophysical and physiological studies are used, as appropriate, to ascertain functional significance of putative traits. Such resources allow for an increasingly integrated understanding of the phenomenon of stress tolerance.

7.2.16. Plant Taxonomy & Conservation research project

Project Leader - Prof. D.S.A. Wijesundara

Introduction to Research Project

One of the main tasks of this project is to develop the NIFS-Popham Arboretum in Dambulla. In addition to that, the project focuses on conducting research related to, a) Taxonomic and Biogeography of flora of Sri Lanka, b) Forest Restoration Ecology, c) Sustainable Use of Sri Lankan Plants, d) Factors affecting the conservation of flora of Sri Lanka including Invasive Alien Species, and e) Preparation of the National Red List for flora.

Activities carried out during the year

The woody vegetation in the NIFS-Popham Arboretum was mapped using GIS software for the one third of the arboretum and research on regeneration is continuing. The interpretative signage system including location maps and informative panels on both flora and fauna was established within the arboretum. The old cottage used by Mr. Popham, before handing over the arboretum to NIFS, foot paths, and foot bridges were repaired.

Research activities on natural products from medicinal and invasive plants were carried out in collaboration with Universities of Peradeniya and Jayawardenapura. Work related to the compilation of National Red list for flora was continued with the assistance of expert teams conducting meetings at the national herbarium.

List of Developed Solutions to address current issues in the country

- Several indigenous trees which have a potential for the use of reforestation in the dry zone of Sri Lanka have been identified.
- Invasive Alien plant species which have chemical compounds that can be used as agrochemicals were identified.
- An invasive aquatic species (*Najas matrina*) which could cause serious damage to fresh water ecosystems in the dry zone was identified and the authorities were informed.

7.2.17. Primate Biology research project

Project Leader –Prof. W. Dittus

The research involves observational studies of monkeys (primates) in their natural forest habitats. Our aims are to: (1) establish new knowledge concerning the evolution of social behavior in primates; (2) provide a scientific basis for nature conservation; and (3) disseminate new knowledge through scientific publications and professionally produced documentary films. These popular media serve not only to educate and entertain, but also to gain public support for conservation in the local and international communities. To date more than 30 such documentaries have been produced, more are planned for the future. The films also advertise a positive image promoting tourism in Sri Lanka.

We test scientific hypotheses of social evolution and behavioral ecology through an interdisciplinary approach that examines the Darwinian outcomes (in terms of survival and reproductive success) of the various inter-relationships among parameters involving population genetics, genealogy, anatomy, epidemiology, physiology, environment and behavior. In practice, at our study site at Polonnaruwa (Sri Lanka), we have identified several thousand individual monkeys. For each macaque (*Macaca sinica sinica* Linnaeus 1771) we have monitored its behavioral, genealogical, ecological and demographic history. To this end we require large samples over an extended period to assure statistical soundness (longevity on wild monkeys may exceed 35 years).

7.2.18. Quantum Physics & Applied Electronics research project

Project Leader –Prof. Asiri Nanayakkara

Introduction to Research Project

In Theoretical Physics and Computational Studies Research Unit at NIFS, we use the tools of theoretical and computational physics to address, explain and understand the physical world surrounding us. This research unit consists of projects under the areas of foundations of quantum mechanics and Single Bubble sonoluminescence (Mysteries of Energy Focusing Phenomena). Specifically, the Quantum Physics Research Group is currently engaged in investigating fundamental aspects of Quantum to Classical Transition, Quantum chaos, Quantum Computing and Quantum non-locality.

Activities carried out during the year

During 2018 we continued carrying out several investigations with regards to quantum and classical correlations and periodic nature of quantum random walks.

In the paper (2010 Phys. Scr. T140 014035), Stefanek et al has proved that for any four-state quantum walk, there cannot be cycles longer than two steps. Our investigations revealed that they have not used the most general form of characteristic polynomials in their proof. Consequently, the result is not generally valid and hence there can be quantum walks having cycles longer than two steps.

7.2.19. Rhizobium Project research project

Project Leader –Prof. S. A. Kulasooriya

The research program focuses on investigations of the role of developed microbial biofilms in agriculture, plantations and the environment. With the invention of development of microbial biofilms [fungal-bacterial biofilms (FBBs) in particular] in vitro in 2002, several basic research studies were conducted to evaluate their potential as microbial ameliorators in the soil and also in the environment. The studies yielded very promising results. Consequently, biofilm-based biofertilizers called Biofilm biofertilizers (BFBFs) were developed for agriculture and plantation crops (especially non-legumes, e.g. tea, rice, vegetables etc.), tested extensively under field conditions, and were commercialized in 2014. So far, BFBFs have been used over 30,000 acres in the country with a chemical fertilizers (NPK) cut down up to 50%, while increasing crop yields between 10-40%. It is also used in organic agriculture. Researches on BFBFs have also been started in India, Indonesia, Brazil and Iraq.

Current studies are centred on agriculture, health and environmental benefits of the use of BFBFs, and also industrial applications of FBBs.

While the application of chemical fertilizers has now become an integral part of agriculture it has also been realized the world over that the indiscriminate use of such fertilizers in the long term had not given the expected increases in crop yields, but had aggravated environmental pollution. There is therefore international agreement to minimize the use of chemicals in agriculture without compromising on crop yields. The rhizobium project conducts study to improve nitrogen fixation in legume crops by increasing root nodulation and activity by applying rhizobial inoculants prepared from selected and field-tested rhizobia. It had been possible to replace the use of chemical N-fertilizers entirely by the application of rhizobial inoculants without any reduction in crop yields.

7.3 Progress of the Science Education & Dissemination Unit (SEDU)

Objectives:

Foster the exchange of technical and scientific information for the scientific community & promote the public understanding of science.

Forums for the scientific community:

- Special lectures: intended to provide a quick forum for the NIFS scientists and Research Assistants with the eminent scientists visiting the institute and the country
- Journal club meetings: organized for the IFS Research Assistants, for them to get an opportunity to discuss their research problems with the scientists and their peers
- International/National Workshops, symposia and conference

Promotion of public understanding of science:

To build up a scientific culture and to enhance the science tempo of the school community workshops, science camps and training sessions were conducted. In addition, the SEDU conducts programmes for popularization of science through electronic media as well as printed media. SEDU is engaged in popularization of science and disseminating research findings of NIFS in different ways of communication. It holds and daily updates social media networks of NIFS and SEDU such as Facebook, Twitter and LinkedIn which easily enable science communication and dialogue and official websites. Moreover, we write news and feature articles to printed and electronic newspapers. In 2018, around 30 newspaper articles were published to disseminate science to general public. Besides that, one TV, two television news and two radio news programs were conducted.

Category	Number	Target Group
Symposium (ARR)	1	Scientific community
International	2	
Special Lectures/Discussions	12	Scientific community
Journal Club	11	Scientific community
Participating at Exhibitions (Local)	1	General Public
Newspaper Articles	17	General Public
Training Programs	3	School Community
Laboratory visits	8	Scientific & School Community
workshop	1	School Community

Summary of Progress of the Division, based on the Key Performance Indicators (KPIs)

Programme	Number benefited
Science Message Service (Through Twitter, Facebook, Blog, Web page)	226,125
Science YouTube Channel	168,508
NIFS YouTube Channel	11,011
Mobile apps for science students	1,313
Facebook pages (SEDU, NIFS)	112,272
Sinhala Science web -Vidumanpetha	11,141
NIFS web page	89,162
<i>Total benefited from e- programmes</i>	<i>619,532</i>

7.4. Progress of the Library - 2018

The NIFS library was established in 1985 with a small collection of books and journals donated by Prof. Cyril Ponnampertuma, well-wishers and the Asia Foundation. Since then it now has a modest collection of over 6875 books and about 120 Journal titles covering the life, physical and mathematical sciences as well as the philosophy and history of science the fundamental text books, monographs and edited volumes.

Objectives

- Collecting, compiling, retrieving and disseminating information related to our research for the benefit of NIFS research staff and other interested parties, and also NIFS research publications for the benefit of outsiders
- Developing a well-balanced and relevant information collection
- Providing access to information in all formats nationally and internationally
- Creating new technologies and continuously developing facilities for the advancement of learning and research
- Developing opportunities for improving library environments and optimizing existing physical facilities for both users and staff
- Co-operating to promote the aims and objectives of the Institute

Acquisition of Books, Periodicals and Reports

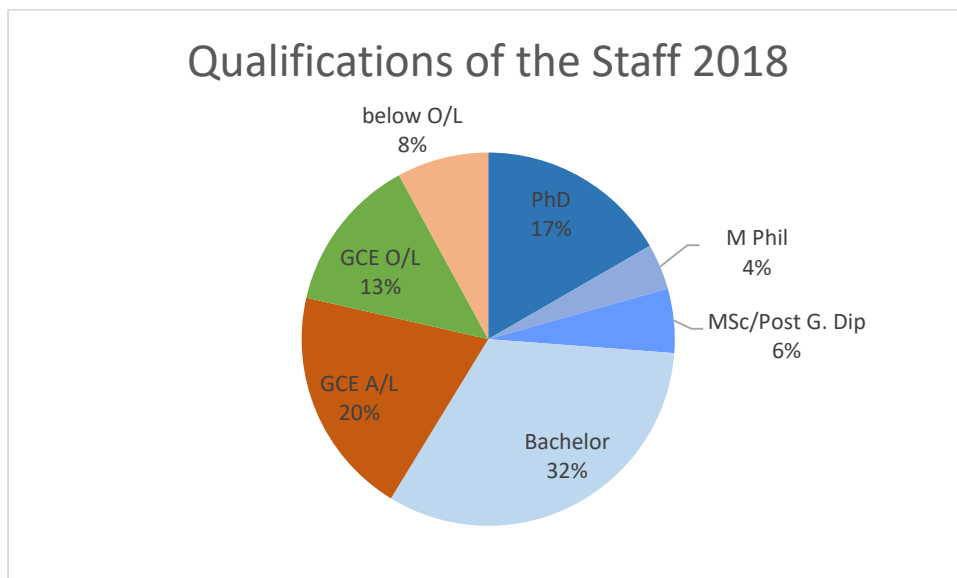
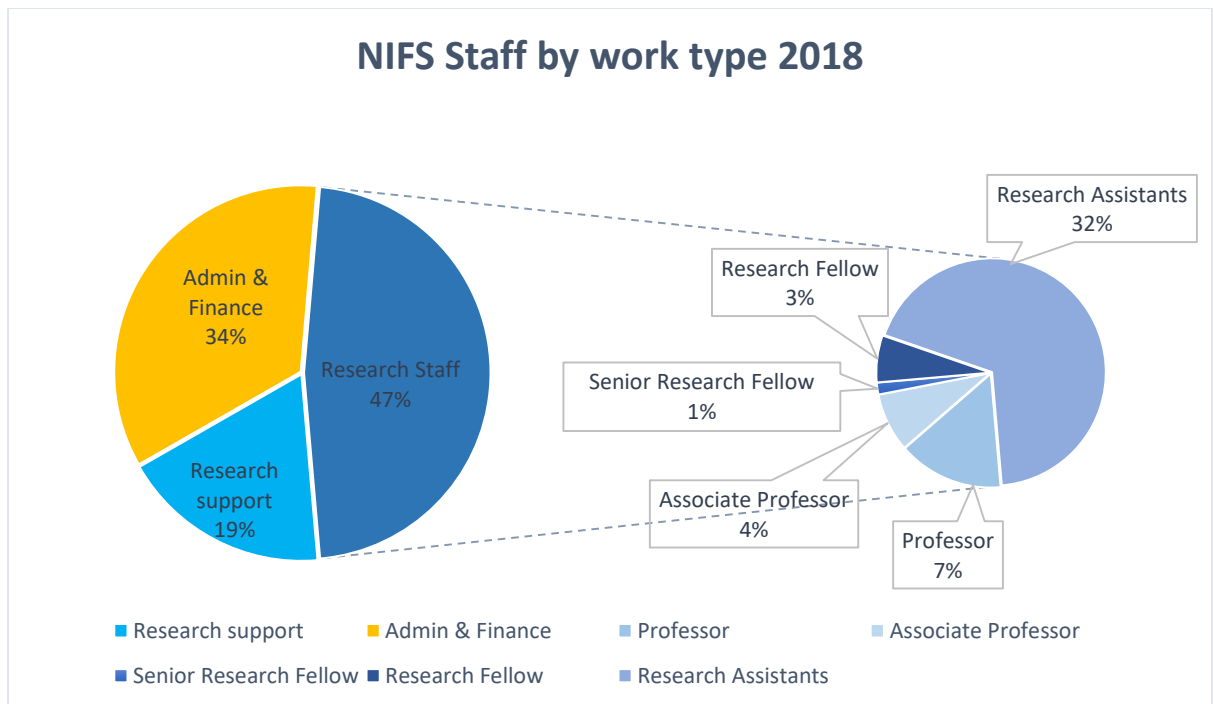
During the last year 90 new books were added to the collection, consisting of 29 purchased books, and 61 books received on complimentary basis. A large number of periodicals, newsletters, and annual reports from local and foreign institutions were also received on a complimentary or an exchange basis, and the library subscribed to 14 journals related to our research.

The current library services

- Reference and lending services
- Document delivery
- Resource sharing
- Inter-library loan facility
- Information alert services
- New item arrivals alert service
- Sourcing web based electronic journals and articles
- Scientific literature updating service (SLUS)
- In addition, we provide updated, necessary information to NIFS administration works (Circulars, E-code etc.)
- Providing access to the internet using updated computers and facilitating library spaces with photocopying and scanning facilities.

8. NIFS Staff strength

8.1 Summary of NIFS Staff



8.2 NIFS Staff 2018 by service Level

Service Level*	Category		Number of employees
Senior Level	Research staff	Director	01
		Senior Research Professors	04
		Research Professors	04
		Associate Research Professors	05
		Senior Research Fellows	01
	Senior Managers	Research Fellows	04
		Secretary	01
		Coordinator/SDU	01
	Middle Managers		
		Accountant	01
		Chief Technical Officers	13
		Laboratory Manager	01
		Senior Assistant Librarian	01
Senior Personal Secretary to the Director		01	
Tertiary level			
		Accounts Officer	01
		Administrative Officer	01
		Communication & Media officer	01
		Internal Audit Officer	01
Secondary Level			
		Senior Staff Assistants	09
		Technical Officer Grade III	03
		Library Assistant Gr. III	01
		Management Assistant Gr. III	10
Primary level			
		Driver- Special Grade	05
		Machinist – Special Grade	01
		Mason - Special Grade	01
		Laboratory Attendant- Special Grade	02
		Record Keeper - Special Grade	01
		Audio Visual Assistant	01
		Karyala Karya Sahayaka- Driver	01
		Office Machine Operator	01
		Driver Gr. III	02
		Lapidarist Gr. III	01
		Machinist Gr. III	01
		Electrician Gr. III	01
	Office Aid	02	

*based on 2/2016 circular sub schedule III

On contract

Visiting Research Professor	05
Visiting Associate Research Professor	01
Research Assistants	29
Research Assistants (grant)	13
Research & Development Officer (project)	01
Field Manager (Project)	01
Technical Assistants (project)	02

8.3 Staff Recruitments & Resignations

8.3.A. Staff recruitment 2018

Director/NIFS	Prof. Saman Seneweera
Research Professor	Prof. S.V.R. Weerasooriya
Associate Research Professor	Prof. Nazrim Marikkar
Research Fellow	Dr. Gayan Bowatte
Research Assistants (Gr.II)	Miss. D.D.M.O. Dissanayake Mr. P.N. Dissanayake Miss. M.A. Farhana Mr. H.D. Jayasinghe Miss. S.D. Jayasekara Miss. H.G.M.K. Karunaratne Mrs. J.M.K.W. Kumari Miss. C.A.U.K. Kumarihami Miss. H.S.T. Kaushalya Miss. S.S.K. Marasinghe Miss. M.G.N. Perera Miss. R.P.S.K. Rajapaksha Miss. A.T.D.Rathnathilake Mrs. D.G.S.N.Samarasinghe Mr. K.Umair
Accounts Officer	Miss. P.H. Wijesuriya
Management Assistant (Gr.III)	Mrs. K.B.J.B.K. Bandara
Audio Visual Assistant	Mr. M.C.V.B. Senavirathne
Electrician (Gr.III)	Mr. T.R. Peiris
Office Aide	Mr. A.G.J.S. Bandara

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8.3.B. List of Resignation

Communication & Media Officer	Mr. S.D.P.G.P. Piyathilake
Audio Visual Assistant	Mr. D.P.D.M. Senadheera
Research Assistant Gr.I	Mr. C.A. Thotawatthage
Research Assistants Gr.II	Mrs. K.M.U.J. Bandara Mr. K.V.G.S. Bandara Miss D.M.D.M. Dissanayake Mr. D.R.L. Dodangodage Miss. N. Kanesharatnam Mr. R.I.C.N. Karunaratne Mr. P.A.R.P. Kumara Miss. C.A.U.K. Kumarihami Miss. N. Padmanadan Mrs. R.P.S.K. Rajapaksha Mrs. U.G.S.L. Ranasinghe Miss. R. Vishvanathan Mrs. W.M.L.S. Weerasundara

8.4 Capacity Building / Skill Development Programs

(Attended by Scientists, Research Assistants & Non-Research Staff)

8.4.A Training

Related to research work

- I. Mr. H.M.D.A.H. Bandara Trained at an International Programme on Geochemical study of Charnockite Complex in Northern Sri Lanka from 2018-05-01 to 2018-08-31 at Niigata, Japan.
- II. Miss. Disanayake D. M. D. M., Trained at an International Workshop on Advance Analytical Chemistry from 2018-10-22 to 2018-11-02 at India.
- III. Ms. S. Gunarathne, and Ms. S.W. Meepegamage Trained at a Programme on Lab demonstration on 2018-08-20 at National Institute of Fundamental Studies.
- IV. Ms. S. Gunarathne, and Ms. S.W. Meepegamage Trained at a Programme on Laboratory demonstration on 2018-08-13 at Microbial Biotechnology Unity, National Institute of Fundamental Studies.
- V. Prof. D.N. Magana-Arachchi Trained at a Workshop on General awareness training on ISO/IEC 17025: 2017 from 2018-02-21 to 2018-02-23 at Sri Lanka accreditation board, Colombo.
- VI. Mr. T. Jaseetharan Trained at an International Programme on *Research training* from 2018-11-01 to 2018-10-31 at Chalmers University of Technology, Gothenburg, Sweden.

- VII. Miss. T.M. Paravithana, and Ms. S.D. Jayasekara Trained at a National Workshop on *Short Course on Data Analysis Using R & R Studio* from 2018-12-27 to 2018-12-28 at Faculty of Science, University of Peradeniya.
- VIII. Ms. S.D. Jayasekara Trained at a National Workshop on *Isotope Techniques in Water Resources Management* on 2018-12-20 at Central Environmental Authority.
- IX. Ms. S.K. Jayasekara, A. Thurairajah, S. Meepegamage Trained at a National Workshop on *Training Workshop on DNA sequencing* from 2018-01-26 to 2018-01-27 at Department of Microbiology, Faculty of Medicine, University of Peradeniya.

1. Participation Related to research work

- I. Ms. E.M.U.A. Ekanayake Ms. M.A.Y.N. Weerasinghe and Ms. J.M.P.S. Madamarandawala Participated at a National Conference on Scientific Sessions of The Sri Lankan Society for Microbiology on 2018-10-26 at Kandy, Sri Lanka.
- II. Ms. E.M.U.A. Ekanayake Participated at an International Conference on ASM Microbe from 2018-06-07 to 2018-06-11 at Atlanta, USA.
- III. Prof. M.C.M. Iqbal Participated at a National Workshop on Mainstreaming Sustainable Development Goals into National Budget Plans in Sri Lanka on 2018-10-01 at Grand Monarch Hotel, Thalawathugoda.
- IV. Prof. M.C.M. Iqbal Participated at a National Workshop on Planning for cultivation seasons based on climate and weather factors on 2018-01-16 at Presidential Secretariat.
- V. Prof. M.C.M. Iqbal Participated at a National Workshop on Public Expenditure Review on Science and Technology on 2018-08-30 at Ministry of Science, Technology and Research.
- VI. Ms. J.N. Kanagaratnam Participated at a National Symposiums on *International Mineral Symposium - 2018* on 2018-10-20 at BMICH, Colombo.
- VII. Ms. J.N. Kanagaratnam Participated at an International Symposiums on *International Mineral Symposium* on 2018-10-20 at Colombo.
- VIII. Ms. J.N. Kanagaratnam Participated at a National Symposiums on *Annual Sessions of the Geological Society of Sri Lanka* on 2018-02-23 at University of Peradeniya.
- IX. Ms. J.N. Kanagaratnam Participated at a National Symposiums on *Postgraduate Institute of Science Research Congress* from 2018-11-09 to 2018-11-10 at Postgraduate Institute of Peradeniya.
- X. Prof. D.N. Magana-Arachchi Ms. E.M.U.A. Ekanayake and Ms. J.M.P.S. Madamarandawala Participated at an International Conference on 1st Sri Lankan ANRAP Regional Seminar (ANRAPSL1) on Herbal Approaches in Combating Diabetes and Common Tropical Diseases from 2018-01-17 to 2018-01-19 at Kandy, Sri Lanka.

- XI. Prof. D.N. Magana-Arachchi Ms. E.M.U.A. Ekanayake and Ms. J.M.P.S. Madamarandawala Participated at an International Conference on South Asian Biotechnology Conference 2018 from 2018-01-28 to 2018-01-30 at Colombo, Sri Lanka.
- XII. Prof. D.N. Magana-Arachchi Ms. M.A.Y.N. Weerasinghe and Ms. J.M.P.S. Madamarandawala Participated at a National Symposiums on "Air That We Breathe" Seventh National Symposium on Air Resource Management in Sri Lanka on 2018-08-08 at Colombo, Sri Lanka.
- XIII. Prof. D.N. Magana-Arachchi Participated at a National Programme on 'Delivering a safer world', National Seminar Organized in line with the World Accreditation Day 2018 on 2018-06-21 at Kingsbury Hotel, Colombo.
- XIV. Prof. D.N. Magana-Arachchi Participated at a National Programme on "Validation workshop on formulation of intellectual property policy for Sri Lanka on 2018-06-11 at Institute of Policy Studies of Sri Lanka.
- XV. Prof. D.N. Magana-Arachchi Participated at a National Programme on The National policy and governing mechanisms of the National Genome Centre and National Genome Data Repository - Stakeholders' meeting on 2018-05-11 at Sri Lanka Institute of Development Administration (SLIDA).
- XVI. Prof. D.N. Magana-Arachchi Participated at a National Workshop on Air quality assessment for health and environment policies on 2018-09-12 at Waters Edge, Battaramulla.
- XVII. Prof. D.N. Magana-Arachchi Participated at a Workshop on "In-house seminar to discuss and finalize the draft basic science research policy for Sri Lanka" on 2018-05-16 at National Institute of Fundamental Studies.
- XVIII. Prof. D.N. Magana-Arachchi Participated at a Workshop on "Water: Planning for the Future" A joint Sri Lankan-South African Seminar on 2018-11-12 at Kandy, Sri Lanka.
- XIX. Prof. D.N. Magana-Arachchi Participated at a Workshop on Preparation of Corporate plan - Ministry of Science, Technology & Research from 2018-02-19 to 2018-02-20 at SANASA Campus - Kegalle.
- XX. Prof. D.N. Magana-Arachchi Participated at a Workshop on Second Annual Australia- Sri Lanka Workshop on CKDu on 2018-12-06 at Colombo, Sri Lanka.
- XXI. Ms. S.W. Meepegamage Participated at a Training workshop on DNA Sequencing Workshop from 2018-01-26 to 2018-01-27 at Faculty of Medicine, University of Peradeniya.
- XXII. Ms. D.G.S.N. Samarasinghe Participated at a National Conference on 38th Annual Sessions of the Institute of Biology, Sri Lanka on 2018-09-28 at Colombo, Sri Lanka.
- XXIII. Ms. D.G.S.N. Samarasinghe Participated at an International Symposiums on Pure and Applied Sciences (IRSPAS) 2018 on 2018-10-26 at Kelaniya, Sri Lanka.

- XXIV. Prof. S. Seneweera, Prof. D.S.A. Wijesundera, and Prof. M.C.M. Iqbal Participated at a National Workshop on Green Climate Fund on 2018-12-20 at Ministry of Mahaweli Development and Environment.
- XXV. Ms. M.A.Y.N. Weerasinghe Participated at a National Conference on 74th Annual Scientific Sessions of Sri Lanka Association for the Advancement of Science from 2018-12-02 to 2018-12-08 at Colombo, Sri Lanka.
- XXVI. Prof. D.S.A. Wijesundara Participated at an International Workshop on UNESCO Global Geo Park Workshop from 2018-05-26 to 2018-05-30 at Oki Islands Global Geo Park, Osaka, Japan.
- XXVII. **Prof. N.D. Subasinghe** Participated at a National Programme on *Development of Biodiversity Ecosystem Services Indicators and Guidelines* from 2018-10-14 to 2019-12-31 at Colombo.
- XXVIII. **Prof. D.S.A. Wijesundara** Participated at an International Conference on *Asian Network of Research on Anti-Diabetic Plants (ANRAP) Conference and gave a talk on Medicinal Plants of Sri Lanka – cornerstone of indigenous medicine* on 2018-01-18 at Kandy.

Other training programmes are listed below:

Name	Name of the Training Program	Institute / Training Provider	Funding Agency/ Institute	Time period
Gayan Senarath Bandara	Documentary video Production (Videography and Video Editing)	Video unit at the National Agriculture Information and Communication Centre (NAICC)	NIFS	Three Months
Mr. V. Ekanayake	<i>Using Google Services to increase the productivity of the office environment</i>	Ministry of Science, Technology and Research	NIFS	2018-10-18
Mr. V. Ekanayake	Workshop on e-Government, Cyber Security and Social Media	National Library and Documentation Services Board	NIFS	2018-10-16
Ms. T.C.P.K. Tilakaratne,	Workshop on e-Government, Cyber Security and Social Media	National Library and Documentation Services Board	NIFS	2018-10-16
Ms. S.S.K. Sakalasooriya	Competency Development Program for Technical Officers	National Human Resources Development Council. Place - University of Putra, Malaysia	NIFS	07 days (26th June - 02nd July 2018)

Name	Name of the Training Program	Institute / Training Provider	Funding Agency/ Institute	Time period
Ms. R.K.C. karunaratne	Competency Development Program for Technical Officers	National Human Resources Development Council. Place - University of Putra, Malaysia	NIFS	07 days (26th June - 02nd July 2018)
R. M. Witharana	Workshop on Open Source Digital Library - DSpace	The National Science Foundation	NIFS	25th & 26th Jly 2018
Isuri Rathnayaka	One-day workshop on Motivation for Sustainable Working Life	National Institute of Fundamental Studies, Kandy	National Institute of Fundamental Studies, Kandy	30th May 2018
Isuri Rathnayaka	Training workshop on GC analysis, HPLC and ICP –OES by Perkin-Elmer	Techno Solution Pvt Ltd.	Techno Solution Pvt Ltd.	6 th of August 2018
Isuri Rathnayaka	Workshop on Scientific Writing	NIFS-Young Scientists Association	NIFS-Young Scientists Association	28th of August 2018

- "Workshop on Motivation for Sustainable Working Life for Non-Academic Staff-NIFS"* was organized by the Science Education and Dissemination Unit of NIFS for the NIFS Staff at the The Royal Mall, Kandy on 2018-05-30 with 58 participants. Resource Person: Ms. K.M.S.D. Jayasekara Additional Director General (Training & Learning) Sri Lanka Institute of Development Administration.

9. AUDITED FINANCIAL STATEMENT

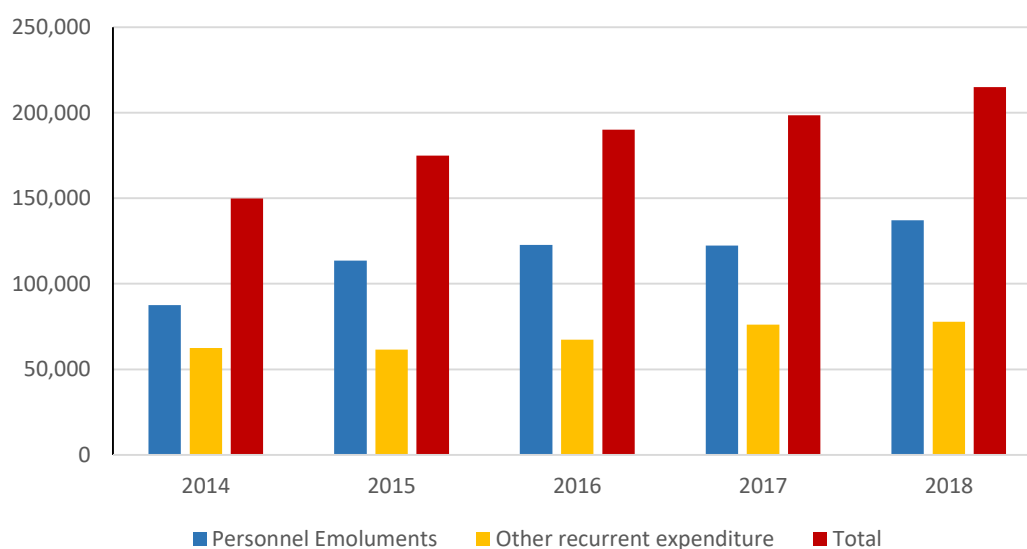
9.1 Summary of Financial Results

9.1.1 Comparison of Expenditure with previous years

9.1.1.1 Recurrent Expenditure comparison- five years

Rs.'000

	2014	2015	2016	2017	2018
Personnel Emoluments	87,509	113,491	122,808	122,430	137,142
Other recurrent expenditure	62,360	61,473	67,293	76,188	77,815
Total	149,869	174,964	190,101	198,618	214,957



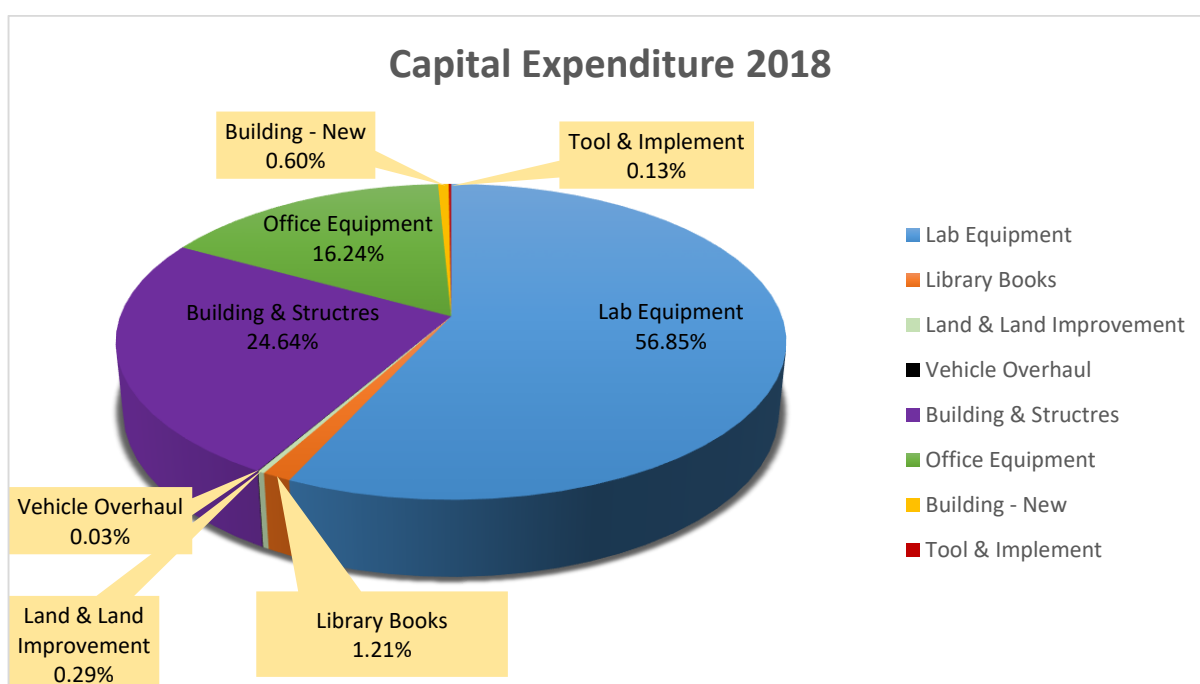
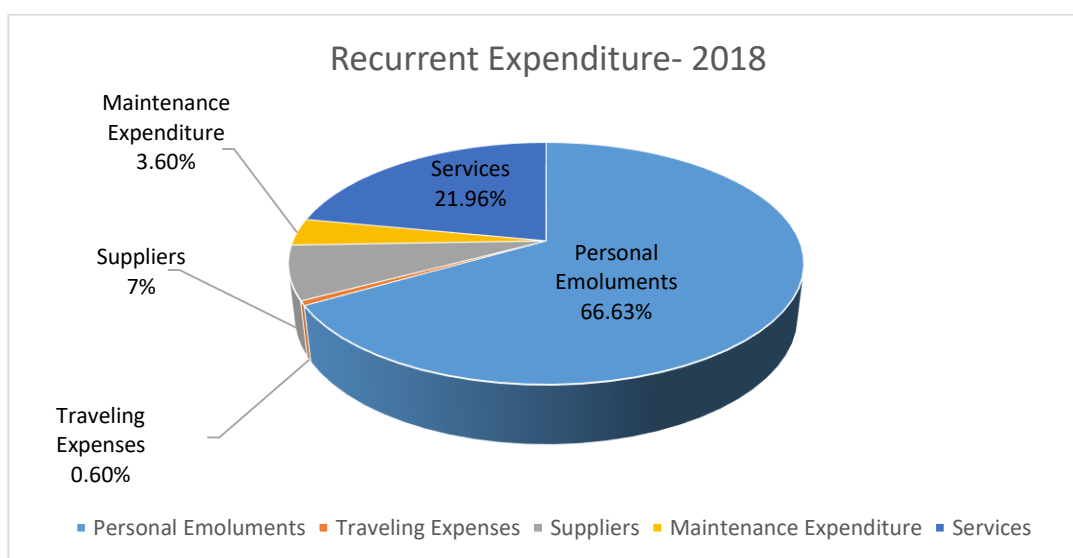
9.1.2. Capital Expenditure comparison- five years

Rs.'000

Year	2014	2015	2016	2017	2018
Acquisition of fixed assets	787	741	4,782	5,874	19118
Building Construction	111,113	43,852	125,261	110,674	58374
Research & Development	-	-	-	-	15458
Total	11,900	44,593	130,043	116,548	92,950

9.2 Summary of financial results for the year ending 31.12.2018

	Recurrent		Capital	
	Amount (Rs. '000)	%	Amount (Rs. '000)	%
2017				
Budgeted	260,040	100	175,000	100
Approved	188,000	72.30	99,000	56.57
Released	187,677	72.17	68,978	39.42
2018				
Budgeted	276,189	100	267,516	100
Approved	190,000	68.79	120,000	44.86
Released	185,023	66.99	98,194	36.71



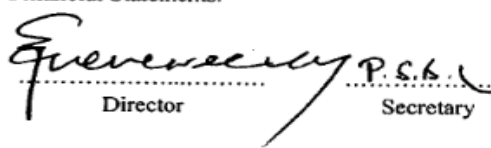
9.3 Statement of financial position

NATIONAL INSTITUTE OF FUNDAMENTAL STUDIES SRI LANKA

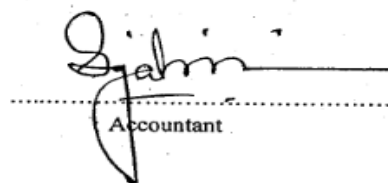
STATEMENT OF FINANCIAL POSITION AS AT 31.12.2018

		SLRs	(RESTATED) SLRs
	NOTE	2018	2017
ASSETS			
CURRENT ASSETS			
CASH AND BANK BALANCES	1	150,529,455.87	126,262,805
DEPOSITS PREPAYMENTS & ADVANCES	2	14,022,034.93	21,803,603
DISPOSAL OF FIXED ASSETS		59,669.77	24,915,351
FESTIVAL ADVANCE FUND INVESTMENT		300,000.00	300,000
CONSUMPTION LOAN FUND INVESTMENT		296,325.37	268,148
INTEREST RECEIVABLE FOR FIXED DEPOSITS		7,244,021.68	6,612,944
STAFF CONSUMPTION LOAN	3	4,805,947.00	4,628,889
ADVANCE AND OTHER RECEIVABLE	4	152,371.37	184,361
STOCKS	5	2,295,588.01	2,343,616
		179,705,414.00	187,319,717
NON-CURRENT ASSETS			
WORK IN PROGRESS	6	17,455,039.83	2,160,000
PRELIMINARY EXPENSES FOR CONSTRUCTION		711,307.36	602,688
PROVIDENT FUND INVESTMENT	7	111,505,089.10	89,274,352
TRAINING CAPACITY		949,197.40	949,197
MEGA PROJECT- RECHARGEABLE BATTERIES		939,080.25	-
PROPERTY, PLANT AND EQUIPMENT	8	593,270,578.38	561,843,551
		724,830,292.32	654,829,788
TOTAL ASSETS		904,535,706.32	842,149,505
LIABILITIES			
CURRENT LIABILITIES			
ACCOUNTS PAYABLE	9	8,838,188.62	6,500,267
ACCRUED EXPENSES	10	3,388,598.85	2,017,959
		12,226,787.47	8,518,226
NON CURRENT LIABILITIES			
SPECIFIED FUNDS & GRANTS	11	150,873,194.69	117,325,573
DEFERRED LIABILITIES	12	38,991,294.58	28,510,186
		189,864,489.27	145,835,759
TOTAL LIABILITIES		202,091,276.74	154,353,985
NET ASSETS		702,444,429.58	687,795,520
NET ASSETS/EQUITY			
CAPITAL FUND - SPENT	13	743,606,249.81	659,406,939
- UNSPENT		99,020,834.19	85,026,601
PRESIDENT'S FUND - SPENT		7,078,501.15	7,078,501
ASSET REVALUATION RESERVE		118,388,385.47	131,630,743
INSTITUTE FUND		(265,649,541.04)	(195,347,264)
TOTAL NET ASSETS/EQUITY		702,444,429.58	687,795,520

The Accounting policies on pages 1 to 3 and other notes on pages 11 to 32 form and integral part of these Financial Statements. The Board of Directors is responsible for the presentation and preparation of these Financial Statements.


Director

Secretary


Accountant

9.4. Statement of financial performance

NATIONAL INSTITUTE OF FUNDAMENTAL STUDIES

SRI LANKA

STATEMENT OF FINANCIAL PERFORMANCE FOR THE YEAR ENDED 31.12.2018

(RESTATED)

	NOTE	SLRs 2018	SLRs 2017
OPERATING REVENUE			
RECURRENT GRANT		185,023,000.00	187,677,000.00
OTHER INCOME	14	19,458,216.21	12,540,762
		204,481,216.21	200,217,762
EXPENDITURE			
PERSONAL EMOLUMENTS	15	137,141,763.52	122,430,103
TRAVELLING	16	1,292,368.74	1,322,542
SUPPLIERS & CONSUMABLE	17	15,488,478.95	14,008,797
MAINTENANCE	18	7,747,093.69	10,372,102
CONTRACTUAL SERVICES	19	22,079,521.06	22,084,134
DEPRECIATION		85,112,270.90	75,061,612
OTHER EXPENSES	20	31,207,821.37	28,400,319
TOTAL OPERATING EXPENSES		300,069,318.23	273,679,609
DEFICIT FROM OPERATING ACTIVITIES		(95,588,102.02)	(73,461,847)
FINANCE COST			
PROFIT/(LOSS) OF FIXED ASSETS		(8,483,398.08)	-
NET DEFICIT FOR THE YEAR		(104,071,500.10)	(73,461,847)

9.5 Statement of cash flow

NATIONAL INSTITUTE OF FUNDAMENTAL STUDIES SRI LANKA

STATEMENT OF CASH FLOW FOR THE YEAR ENDED 31.12.2018

	REFERENCE	SLRs. 2018		(RESTATED) SLRs. 2017
Cash-Flow from Operating Activities				
Deficit for ordinary activities	Page 5	(104,071,500)	(104,071,500)	(73,461,847)
				(73,461,847)
<u>Non Cash Movements</u>				
Depreciation	Page 19 - Note 8	85,112,271		75,061,612
Amortization of the Deferred Liability	Page 25 - Note 14	(504,182)		-
Loss on Disposal of Capital Assets	Page 5	8,483,398		-
Provision for Gratuity	Page 28 - Note 20	6,075,930		8,557,091
(Increase)/Decrease Staff Consumption Loan	Page 4 - Note 3	(177,058)		(311,887)
(Increase)/Decrease Stocks	Page 4 - Note 5	48,028		(97,464)
(Increase)/Decrease Advance and other Receivable	Page 4 - Note 4	31,990		376,159
(Increase)/Decrease Deposits, prepayment and Advances	Page 4 - Note 2	7,781,568		31,604,328
Increase/(Decrease) Accounts Payable	Page 6 & 4 - Note 9	2,337,922		5,212,121
Increase/(Decrease) Accrued Expenses	Page 4 - Note 10	1,370,640		21,832
Gratuity Paid		(571,238)		(644,341)
			109,989,268	
Net Cash flow from Operating Activities			5,917,768	46,317,605
<u>Cash Flow from Investing Activities</u>				
(Increase)/Decrease Working in progress	Page 4 - Note 6	(15,295,040)		170,011,885
Purchase of Property Plant & Equipment	Page 4 & 19-Note 8	(74,159,552)		(326,192,772)
(Increase)/Decrease Int.rec.for Fixed Deposits	Page 4	(631,078)		(2,091,211)
Construction	Page 4	(108,619)		(602,688)
Investments made- Provident Fund	Page 4 - Note 7	(22,230,737)		(12,348,683)
- Consumption Loan Fund	Page 4	(28,177)		113,087
-Mega Project	Page 4	(939,080)		-
			(113,392,283)	
Net Cash Flow from Investing Activities			(113,392,283)	(171,110,380)
<u>Cash Flows from Financing Activities</u>				
Government Capital Contribution	Page 6	98,193,544		68,978,379
Specific Funds and Grants	Page 4 - Note 11	33,547,622		17,082,994
			131,741,166	
Net Cash Flow from Financing Activities			131,741,166	86,061,373
Net increase/ (Decrease) in cash and cash equivalent			24,266,651	(38,731,402)
Cash and cash equivalent at beginning of period	Page 11 - Note 1		126,262,804	164,994,206
Cash and cash equivalent at the end of the period	Page 11 - Note 1		150,529,455	126,262,804

9.6 Statement of changes in net assets/equity

NATIONAL INSTITUTE OF FUNDAMENTAL STUDIES

SRI LANKA

STATEMENT OF CHANGES IN NET ASSETS/EQUITY FOR THE YEAR ENDED 31.12.2018

ATTRIBUTABLE TO OWNERS OF THE CONTROLLING ENTITY					
	CONTRIBUTED CAPITAL	PRESIDENT FUND	REVALUATION SURPLUS	INSTITUTE FUND	TOTAL NET ASSEST/EQUITY
BALANCE AS AT 31 DECEMBER 2017	744,433,540.00	7,078,501.15	131,630,743.37	(195,845,698.45)	687,297,086.07
ADD: FUND ADJUSTMENT IN LAST YEAR	-	-	-	498,434.88	498,434.88
BALANCE AS AT 31 DECEMBER 2017 (RESTATED)	744,433,540.00	7,078,501.15	131,630,743.37	(195,347,263.57)	687,795,520.95
REVALUATION DEFICIT/SURPLUS	-	-	19,440,505.63	-	19,440,505.63
FIXED ASSET PURCHASE FROM GRANT	-	-	-	2,160,957.87	2,160,957.87
ADDITION DURING THE YEAR TO INSTITUTE FUND	-	-	-	31,608,264.76	31,608,264.76
DEFICIT FROM OPERATING ACTIVITIES	-	-	-	(104,071,500.10)	(104,071,500.10)
DESPOSAL OF FIXED ASSETS	-	-	(32,682,863.53)	-	(32,682,863.53)
CAPITAL FUNDS RECEIVED FROM GOVERNMENT & OTHER SOURCES	98,193,544.00	-	-	-	98,193,544.00
BALANCE AS AT 31 DECEMBER 2018	842,627,084.00	7,078,501.15	118,388,385.47	(265,649,541.04)	702,444,429.58

9.7 Accounting policies for year 2018

NATIONAL INSTITUTE OF FUNDAMENTAL STUDIES - SRI LANKA SIGNIFICANT ACCOUNTING POLICIES YEAR ENDED 31ST DECEMBER 2018

(1) GENERAL ACCOUNTING POLICIES

- 1.1** The financial statements have been prepared on the basis of historical costs in accordance with the Sri Lanka Public Sector Accounting Standards for the accrual basis accounting and no adjustments have been made for inflator factors affecting these accounts, instead of Motor Vehicle re-valuation according to the special Re-valuation committee.
- 1.2** Similarly Laboratory Equipment, Machinery Tools & Implements, Refrigerators, Air Conditioners, Communication Equipment, Office & Miscellaneous Equipment, Sports Items are re- valued by the Special Re-valuation Committee and there is no inflator factors affecting to the accounts.
- 1.3** The value of Revaluation of Fixed Asset in 2011 and the value of Motor Vehicle in 2015 and 2018 have been shown as Revaluation Reserve being adjusted by Institute Fund Account. The Revaluation of Motor Vehicles has been done by Examiner of Motor Vehicles of Department of Motor Traffic, Kandy with effective dates of 16.02.2015, 20.02.2015 and 27.08.2018 at current market value.
- 1.4** Previous year figures and phrases have been re-arranged wherever necessary to confirm to the current presentation.

1.5 CONVERSION OF FOREIGN CURRENCIES

All foreign exchange transactions are converted of the rate of exchange prevailing at the time the transactions were affected. Non-resident foreign currency account balance has been translated at the rate of exchange prevailing at the date of Statement of Financial Position.

1.6 TAXATION

Under the provision of sections 8(a) (xxxix) and 42 (ff) of the Inland Revenue Act No. 28 of 1979 (as amended) the Institute is exempted from income tax in Sri Lanka.

(2) ASSETS AND BASES OF THEIR VALUATION

2.1 STOCKS:

Stocks have been valued at historical cost basis and all issues are valued at FIFO Basis.

2.2 FIXED ASSETS:

- 2.2.1** The cost of fixed assets is the cost of purchase or construction together with any incidental expenses thereon. The fixed assets are recorded at cost and accumulated depreciation which is provided in the depreciation on the basis specified in 2.2.2
- 2.2.2** The cost of Library Books includes a Heritage Asset (Mapping Report) amounting to Rs. 1,097, 477.65 which is not depreciable.
- 2.2.3** The cost of Lab Equipment and Office & Miscellaneous Equipment includes Assets which are kept for display purpose and are represented at Written Down Value of Rs. 16,317,450.00 and Rs. 770,940.00 respectively.

2.2.4 Fixed assets received as Donations, have been recognized as Deferred Liability from year 2018.

2.2.5 DEPRECIATION OF FIXED ASSETS

The provision for depreciation has been calculated on the cost of fixed assets in order to write-off such costs over the estimated useful lives as follows:

Motor vehicles	20%
Library books	33.33%
Building	10%
Lab Equipment	10%
Sports goods	33%
Computers	25%
Computer Software	25%
Furniture & fittings	10%
Communication	10%
Air - Conditioners	10%
Refrigerators	10%
Machinery Tools & Implements	10%
Office & Miscellaneous	
Room Linen	33.33%
Crockery Cutlery & Canteen Equipment	33.33%
*Safety Equipment	10%
Office Equipment	20%
Sundry Assets	10%
Expandable Assets	10%

* Safety Equipment - Rate of depreciation had been changed from 33.33% to 10% with effect from 1999.

The depreciation of Fixed Assets is provided from the date of purchase to the date of disposal.

2.3 INVESTMENT

Employer's and employees' contributions made towards the NIFS provident fund has been invested in fixed deposits at the National Savings Bank.

2.4 Contribution made towards Consumption Loan Fund has been deposited in Savings Account at the National Savings Bank.

(3) LIABILITIES AND PROVISIONS

3.1 All known liabilities and provisions as at the date of the Statement of Financial Position have been provided for in the accounts.

3.2 RETIREMENT GRATUITY

Provision is made in these Accounts for retirement gratuity payable under the payment of Gratuity

Act No.12 of 1983 in respect of employees with 5 or more years of continued service in the Institute.

This item is grouped under deferred liabilities in the Statement of Financial Position.

3.3 NIFS. PROVIDENT FUND

Members' fund as at 31st December 2018 are shown under Specified funds in the Statement of Financial Position.

(4) REVENUE RECEIPTS

4.1 GOVERNMENT GRANT

Government grant received during the year under review towards the recurrent expenditure has been charged to the Statement of Financial Performance for the year. Total revenue and capital funds of the Institute accumulated from the previous years have been shown as Institute funds in the Statement of Financial Position.

4.2 FOREIGN AND OTHER GRANTS

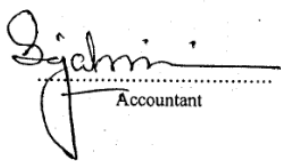
All foreign and other monetary grants received during the year, are dealt with by charging to the Statement of Financial Performance to the extent of such grants recognized in the Financial Statements do match with the associated costs incurred during the year. Unspent grants during the year are shown under specified funds and grants in the Statement of Financial Position.

4.3 RESEARCH GRANT FUND

The unutilized specified grant balances have been shown as the Research Grant Fund under Specified funds & grants in the Statement of Financial Position.

(5) UTILIZATION OF BUDGET ALLOCATION

The Revised Budget Estimate has been shown in the estimation and the previous year Capital Funds have been utilized in the reporting year.



Accountant

10. AUDIT & MANAGEMENT COMMITTEE REPORT

The Audit and Management Committee of the National Institute of Fundamental Studies (NIFS) is appointed by the Board as a subcommittee of the Board of Governors to examine internal controls and financial affairs of the NIFS.

Meetings During the year ended 31st December 2017, the Audit and Management Committee held 4 meetings. The Chief Operating Officer, who is the Director of the Institution, was invited for all Audit and Management Committee meetings.

Discussions were held with the external auditors regarding the scope and the conduct of the annual audits.

Internal Audit and Risk Management

The Internal Audit Programme was reviewed by the Committee to ensure that it covered the major divisions and activities of the Institution.

The Audit and Management Committee scrutinized and discussed the internal audit reports and audit queries submitted by the Auditor General on internal controls of the Institute ensuring that processes are in place to safeguard the assets of the organization and to ensure that the financial reporting system can be relied upon in the preparation and presentation of financial statements.

The Accountant was invited to be present at all Audit and Management Committee meetings and clarifications were made related to financial operations of the NIFS.

The Internal Audit Officer was invited to be present at all Audit and Management Committee deliberations. He presented a summary of the salient internal audit findings and details of the investigations carried during the period.

The responses of the relevant heads of the divisions to the internal audit findings were reviewed and where necessary corrective actions were recommended.

Internal controls

During its meetings, the Committee reviewed the adequacy and effectiveness of the internal control systems of the Institution giving more attention to the exposure to the financial risks.

Financial statements

The Committee reviewed the Financial Statements of the Institution and the Annual Report for reliability, consistency and compliance with the Sri Lanka Public Sector Accounting Standards and other financial regulations prior to issuance. The Committee also reviewed the adequacy of disclosure in the Financial Statements.

External auditors

The Committee reviewed the Audit Report on annual financial statements issued by the Auditor General's Department, the Management responses thereto and also attended to matters specifically addressed to them. The external auditors kept the Audit and Management Committee informed on an on-going basis of all matters of significance. The Committee met with the Audit Superintendent during meetings and discussed issues arising from the audit and recommended corrective action where necessary.

Conclusion

The Audit and Management Committee is of the view that the control environment prevailing in the Institution provides reasonable assurance regarding the reliability of the financial reporting of National Institute of Fundamental Studies, the assets are safeguarded and that the government rules and regulations have been complied with and also the audited accounts are free from any material mis-statements.

11. REPORT OF THE AUDITOR GENERAL ON THE FINANCIAL STATEMENT

Report of the Auditor General on the Financial Statements and legal and regulatory requirements of the National Institute of Fundamental Studies for the year ended 31 December 2018 in terms of Section 12 of the National Audit Act, No. 19 of 2018.

1. Financial Statements

1.1 Qualified Opinion

The audit of the financial statements of National Institute of Fundamental Studies for the year ended 31 December 2018 comprising the statement of financial position as at 31 December 2018 and the statement of financial performance, statement of changes in equity and cash flow statement for the year then ended, and notes to the financial statements, including a summary of significant accounting policies, was carried out under my direction in pursuance of provisions in Article 154 (1) of the Constitution of the Democratic Socialist Republic of Sri Lanka read in conjunction with provisions of the National Audit Act No. 19 of 2018. In terms of Article 154 (6) of the Constitution of the Democratic Socialist Republic of Sri Lanka, my report shall be tabled in Parliament in the future.

In my opinion, except for the effects of the matters described in the Basis for the Qualified Opinion of this report, the financial statements give a true and fair view of the financial position of the Institute as at 31 December 2018, and of its financial performance and its cash flows for the year then ended in accordance with Sri Lanka Public Sector Accounting Standards.

1.2 Basis for the Qualified Opinion

(a) Sri Lanka Public Sector Accounting Standards

- (i) In terms of Paragraph 99 of the Sri Lanka Public Sector Accounting Standards 01, all income and expense items identified during the period must be included in the statement of financial performance. However, the income and expense for the year under review of

the Institute's 29 projects and 12 programs and workshops amounted to Rs.32,116,648 and Rs.17,659,343 respectively had not been recorded in the statement of financial performance. An uncategorized amount of Rs.15,498,385 which was representing the recurrent expenditure was recorded as income and expenditure in the statement of financial performance.

- (ii) A change in a voluntary accounting policy as defined in Paragraph 24 (a) of the Sri Lanka Public Sector Accounting Standards 03 must be applied retrospectively. As a new policy for amortization of fixed assets donated to the Institution, the respective amortization has been recognized as income amounting to Rs.504,182 for the year under review. However, this policy was not disclosed, nor the adjustments were made retrospectively.
- (iii) In terms of Paragraph 75 of the Sri Lanka Public Sector Accounting Standards 07, the depreciation method used for assets should be reviewed at least on every annual reporting date, and if there is a significant change, the depreciation should be changed and accounted for in accordance with the Sri Lanka Public Sector Accounting Standard No. 03. However, due to the fact that the depreciation method used for Institution's non-current assets had not been revised, there were assets amounting to Rs.123,805,941 being used even though they were fully depreciated. Accordingly, the estimated error was not rectified in accordance with the Sri Lanka Public Sector Accounting Standard No. 03.

(b) Accounting Policies

- (i) Although the amortization of the assets acquired by the government capital grants should be adjusted yearly to the statement of financial performance, amortization adjustments were not made on behalf of the assets acquired by government grants amounting to Rs.75,180,691 during the year and for assets acquired in like manner during previous years. Further, the respective policy was not disclosed in the financial statements.

- (ii) The year end balance of the revaluation reserve was Rs.118,388,385. However, the Institute had not disclosed the policy for the revaluation surplus in the financial statements.

(c) Accounting Deficiencies

- (i) A refrigerator purchased in 2007 with a cost of Rs.63,015 was fully depreciated in 2017. However, a depreciation amount of Rs.6,301 was provided during the year under review as depreciation causing an overstatement by that amount in the depreciation expense and accumulated depreciation.
- (ii) The audit fees payable in respect of the year 2017 was not accounted for as an accrued expense.
- (iii) Non-current assets included unserviceable and untraceable assets which were identified by the Board of Survey amounting to Rs.29,853,300 and 6,037,985 respectively.

(d) Lack of Evidence for Audit

A register was not maintained in accordance with the Treasury Circular No. 842 of 19 December 1978, for the fixed assets amounting to Rs.936,095,460.

I conducted my audit in accordance with Sri Lanka Auditing Standards (SLAuSs). My responsibilities, under those standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of my report. I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my qualified opinion.

1.3 Responsibilities of Management and Those Charged with Governance for the Financial Statements

Management is responsible for the preparation of financial statements that give a true and fair view in accordance with Sri Lanka Public Sector Accounting Standards and for such internal

control as management determine is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, management is responsible for assessing the Institute's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the Institute to cease operations, or has no realistic alternative but to do so.

Those charged with governance are responsible for overseeing the Institute's financial reporting process.

As per Sub-section 16 (1) of the National Audit Act No. 19 of 2018, the Institute is required to maintain proper books and records of all its income, expenditure, assets and liabilities, to enable annual and periodic financial statements to be prepared of the Institute.

1.4 Auditor's Responsibilities for the Audit of the Financial Statements

My objective is to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes my opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with Sri Lanka Auditing Standards will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

As part of an audit in accordance with Sri Lanka Auditing Standards, I exercise professional judgment and maintain professional scepticism throughout the audit. I also,

- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for my opinion. The risk of not detecting a material misstatement resulting from fraud is

higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.

- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Institute's internal control.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the management.
- Conclude on the appropriateness of the management's use of the going concern basis of accounting and based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Institute's ability to continue as a going concern. If I conclude that a material uncertainty exists, I am required to draw attention in my auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify my opinion. My conclusions are based on the audit evidence obtained up to the date of my auditor's report. However, future events or conditions may cause the Institute to cease to continue as a going concern.
- Evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

The Management was made aware of important audit findings, key internal control deficiencies and other matters identified in my audit

2. Report on Other Legal and Regulatory Requirements

The following facts expressed according to the National Audit Act No. 19 of 2018.

- According to the Section 12 (a) of the National Audit Act No. 19 of 2018 except for the effects of the matters described in the Basis for the Qualified Opinion of this report,

relevant information and explanations have been obtained reasonably, which in my opinion were necessary for the purpose of the audit, and the Institute has maintained proper financial records.

- According to the Section 6 (1) (d) (III) of the National Audit Act No. 19 of 2018, it could be expressed that the financial statements presented is consistent with the preceding year.
- According to the Section 6 (1) (d) (IV) of the National Audit Act No. 19 of 2018, the recommendations made regarding the financial statements of previous years were included in the financial statements.

Based on the procedures carried out and the evidence gathered, in all material respects, no observations were made which required the following statements.

- 2.1** According to the Section 12 (d) of the National Audit Act No. 19 of 2018, any member of the governing body of the Institute has any direct or indirect interest of non-commercial nature in any contract entered into by the Institute.
- 2.2** According to the Section 12 (f) of the National Audit Act No. 19 of 2018, the Institute has not complied with any applicable written law or other general or special directions issued by the governing body of the Institute, except for the following;

Reference to Laws, Rules and Regulations, etc.	Non-compliance
(a) Financial regulations 102	Action in terms of Financial Regulation had not been taken in respect of untraceable items amounting to Rs.10,219,135.
(b) Financial regulations 770 (2)	Since government forms were not used during the Board of survey as at 31 Decemebr 2017, the recommendations

made by the Board were not included in the report.

- (c) Paragraph 6.5.1 of the Public Enterprises Circular No. PED/12 dated 02 June 2003 Even though, the financial statements should be rendered to the Auditor General within 60 days after the close of the financial year, the Institute has submitted the financial statements for the year ended 31 Decemebr 2018 only on 20 August 2019.

- 2.3 According to the Section 12 (g) of the National Audit Act No. 19 of 2018, the Institute has performed according to its powers, functions and duties, except for the following;

Powers, functions and duties

Observations

- | | |
|---|--|
| <p>(a) Section 14 (1) of the Finance Act, No.38 of 1971</p> | <p>The Institute shall, immediately after the end of each financial year of the Institution, prepare a draft annual report on the exercise, discharge and performance by the Institute of its powers, functions and duties during that year and of its policy and programme. Such report shall set out any directions given by the appropriate Minister to the Institution during the year. Copies of such report shall, within 04 months after the end of that year, be submitted to the appropriate Minister and to the Minister of Finance, the Minister of Planning and the Auditor-General. However, the draft annual</p> |
|---|--|

report for the year under review and the final annual report for the previous year were not prepared as at the date of the audit 29 January 2019.

- (b) Paragraph 5.1.3 of the Public Enterprises Circular No. PED/12 dated 02 June 2003 A Corporate Plan should be prepared for a period not less than 03 years and updated that plan annually and should be forwarded to the Auditor General, General Treasury, Line Ministry and the Department of Public Enterprises at least 15 days before the commencement of each financial year with the approval of the Board of Management. Nevertheless, the Institute had not prepared and presented the Corporate Plan accordingly. Further, the annual Action Plan should be prepared to execute the entire objectives of the Institution. Nevertheless, the Action Plan prepared for the year under review had included only the research projects of the Institution.

2.4 According to the Section 12 (h) of the National Audit Act No. 19 of 2018, the resources of the Institute had been procured and utilized economically, efficiently and effectively within the time frames and in compliance with the applicable laws except for the following;

- (a) Although 3 years have lapsed for the development of the software system for the Institute and Rs.660,000 has been paid as an advance, the service provider has failed to complete the task. The Institution had not charged the late fee as per the agreement but has purchased computer equipment worth of Rs.6,864,960 for this project.

- (b) The procurement plan for the year under review was revised and the Board has granted approval for the same on 29 Decemebr 2018. The overall progress of the procurement activities was 56 per cent. Thus, the procurement plan was not used as an effective control agent.
- (c) Although it is a pre-requisite of the procurement process to ensure the availability of funds, due to the fact that the National Institute of Fundamental Studies not verifying the financial availability at the time of ordering the goods, there were unfinished procurement activities amounting to Rs.9,261,310, US\$ 2,697 and CHF 76,330 during the year under review.
- (d) Due to the unutilization of funds allocated for capital projects during the year under review and prior years, there was an unspent balance of Rs.94,478,204 remaining as at 31 December of the year under review.
- (e) On account of the unauthorized use of Institutional vans by 4 officers of the Institute for the porpose of travelling from Digana quarters to the Institute, there was a loss of Rs.203,852 made to the Institute.

3. Other Audit Observations

- (a) The income collected for the Annual Research Review of the Institution amounting to Rs.1,122,500 was not identified in the budget.
- (b) Out of the research grants received, a balance of Rs. 25,679,319 was remaining as at 31 December of the year under review. There was an unutilized balance of Rs.1,984,035 with related to 6 research projects of previous year. Further, action was not taken to utilize Rs.220,000 received on behalf of 3 projects during the year under review.
- (c) The advance payment made for the import of chemicals to V.W.R. International Ltd. amounting to Rs.55,863 on 18 March 2013 had been written off by Journal entry 476 without taking action to obtain the goods.

- (d) As per 5.2.5 of PED/12 Circular of the Director General of Public Enterprises dated 2 June 2003, the Annual Budget should be used as a tool for achieving long-term objectives in accordance with the Corporate Plan. However, the Amended Budget of the Institute had been approved by the Board of Governors on 29 December 2018. It was observed that the budget of the year had not been effectively used as a financial control agent.
- (e) While examining the current state of observations made by the internal audit division, it was noted that. Out of 29 observations submitted during the year under review, only 6 were resolved.

W.P.C. Wickramaratne
Auditor General

12. OBSERVATIONS OF THE BOARD OF GOVERNORS FOR THE REPORT OF THE AUDITOR GENERAL

National Institute of Fundamental Studies

Observations made and approved by the Board of Governors on 14th February 2020 with regard to the Report of the Auditor General issued on 13th November 2019 on the Financial Statements and other legal and regulatory requirement of the National Institute of Fundamental Studies for the year ended 31st December 2018 in terms of Section 12 of the National Audit Act, No. 19 of 2018.

1.2 (a) Sri Lanka Public Sector Accounting Standards

- (i) Funds received by the Institute for different projects, programs and workshops are separately accounted under the liabilities of the Institute.

Recurrent expenditure incurred on behalf of programs are shown as Foreign & Local Grant Income under Note 14A and as Grant Expenses under Note 20A in the Statement of Financial Performance. Further, the capital expenditure incurred are shown in the Statement of Changes in Net Assets as Fixed assets purchased from Grants.

The respective project and program balances are shown as Specified Grants under Note 11A in the Statement of Financial Position. The remaining funds after the project and program completion are returned to the Institute which granted those funds.

During the year under review, the recurrent expenditure incurred amounting to Rs.15,498,385 is shown as an income under Note 14 A of the Statement of Financial Performance and as an expense under Note 11 A and the capital expenditure amounting to Rs.2,160,957.87 has been shown as Fixed assets purchased from Grants in the Statement of Changes in Net Assets.

The remaining balances of Rs.2,008,563.11 are shown under Note 11 and Rs.23,778,722.17 under Note 11 A.

- (ii) Due to the practical difficulty to separately identify the fixed assets received by the Institute as donations, the retrospective adjustment has not been made during the year under review. However, it is noted to do the necessary adjustments and to disclose the respective accounting policy in the future.
- (iii) The revaluation work on the non-current assets of the Institute is complete. Relevant adjustments will be made accordingly as the valuation reports are received from the Valuation Department. Along with that, values of the assets which are fully depreciated but are still in use, will be revised.

(b) Accounting Policies

- (i) It is noted to do the necessary adjustments by accounting for the amortization with related to assets purchased from government capital grants with an amount equal to annual depreciation charge and to disclose the relevant accounting policy in the financial statements.

National Institute of Fundamental Studies

- (ii) The net result of the disposed assets during the year amounting to Rs.32,682,863.53 has been removed from the revaluation reserve. During the year under review, the revaluation gain on vehicles was Rs.19,440,505.63. Accordingly, there is a balance of Rs.118,388,385. It is noted to make necessary disclosures in the financial statements.

- (c) **Accounting Deficiencies**

- (i) Corrections have been made in the accounts through the journal entry J/226 in order to rectify the erroneous over depreciation amount of Rs.6,301.50 over a refrigerator with a cost of Rs.63,015.

- (ii) Invoice for the Audit fee for the year 2016 has been received and the payment has been made. For the year 2018, Rs.500,000 has been shown as an expenditure and an Accrued expense as Government Audit Fees.

However, the actual payment for audit fees for 2017 was in excess compared to the provision made. As there was no adjustment made for the under-provision, it was noted to make necessary adjustments for the same.

- (iii) Action has been taken to get the unserviceable assets valued by the Department of Valuation and to sell them by auction. Steps have been taken to maintain sub inventory lists in order to detect the untraceable assets. After that, if there are furthermore, untraceable items, action will be taken accordingly.

- (d) **Lack of Evidence for Audit**

As the initial step for the compilation and maintenance of a fixed asset register in accordance with the Treasury Circular and the Government formats, the Institution has revalued its assets with the involvement of the Department of Valuation. The valuation reports are being received now.

Further, the management has considered the efficiency and effectiveness of maintaining the fixed asset register in an electronic format using the SARASA ERP software and relevant testing activities are currently being carried out.

Once the revaluation work is completed, the fixed asset register will be maintained with the inclusion of new values.

2.2 **Non-compliance with Laws, Rules and regulations etc.** -----

- (a) Maintenance sub inventory lists have been initiated in order to locate the missing items. Majority of the missing items are expected to be traced by this approach and if there are furthermore items, action will be taken on those.
- (b) Government general forms have been used during Board of Surveys from 2018 onwards.
- (c) Since the position of the Chairman, which is appointed by the President, was vacant till 23 July 2019, there were no Board meetings held until August 2019.

National Institute of Fundamental Studies

As a result, the financial statements for the year 2018 had to be submitted without the Board approval. However, the National Audit Office declined to accept the financial statements without Board's representation.

Therefore, the submission of the annual financial statements with the Board approval was delayed till August 2019.

2.3

Powers, functions and duties

(a)

2017 Annual Report

On account of the following reasons, 2017 Annual Report could not be submitted on the due date.

1. Due to the resignation of the officer involved in the compilation of Annual Report, the other officers had to cover this task while attending to their routine and urgent duties. As a result, work could not be completed within the stipulated time.
2. The Tamil translation of the Auditor General's report, which is required to be included in the Annual Report was received on 26 October 2018.
3. Afterwards, the draft copy of the Annual Report was prepared and with the approval of the line Ministry, it was sent to print on 31 January 2019.
4. The summary of 2017 Annual Report has been submitted for Cabinet Approval through the line Ministry, and once the approval is obtained, it will be submitted to the Parliament.

2018 Annual Report

The following reasons have caused the delay in the submission of 2018 Annual Report.

1. There was a delay in obtaining Board approval for the annual financial statements till August 2019 as the Chairman's position, which is appointed by the President, was vacant till 23 July 2019. Due to this reason, there were no Board meetings held until August 2019.
2. Submission of the annual financial statements to the Auditor General was made in August 2019 after obtaining the Board approval.
3. The Audit report for the financial year 2018 was received on 13 November 2019.
4. Unlike previous years, additional time was required as the Institute had to do the English and Tamil translations of the Audit Report.

(b)

Work is currently being carried out to prepare a corporate plan for 5-year period in accordance with the Public Enterprise circular and 90% of the work has been completed. For this purpose, the assistance of the Ministry of Science, Technology and

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Research is obtained, and steps will be taken to update this and to obtain approval from the relevant authorities prior to the commencement of each year.

In order to achieve the organizational objectives, steps have been taken to prepare an action plan from 2019 onwards with the inclusion of key performance indicators.

In addition to the annual research activity plans which are included in the action plan, it has been noted to include the procurement plan and other financial and administrative activity plans in the action plan.

2.4

Economy, efficiency and effectiveness of procurement and utilization of resources

- (a) Reasons for the purchase of computer equipment specifically for the ERP software program amounting to Rs.6,864,960 are as follows:

Sever machine (Rs.1,213,270)

A server is required to develop a software package. The software has been developed, stored and maintained in this server machine. Therefore, this equipment was required from the very beginning of the project.

Cheque writing printer (Rs.32,000)

This equipment is used at the Accounts Division for daily routine printing activities.

Computers (Rs.5,030,400)

The Institution required computers with the necessary specifications to accommodate the installation and testing of the software prior to the full implementation of the ERP software.

Therefore, computers with required specifications had to be purchased to install the software. Computers were required for routine and research work too and such requirements were also taken into consideration when making the purchase decision.

New computers were purchased for the reception area and the security division. In order to gather information about the divisional computer requirement, which did not have computers with needed specifications, a survey was conducted as the software installation and testing was not possible without having the required computers.

Divisions which purchased new computers have handed over 9 old computers to the Computer Unit and out of which 2 computers are presently being used by the Computer Unit. 4 more computers have been given to other divisions on their request and 3 computers are beyond repair.

A server costing Rs.1,997,604 was purchased for the Computer Unit and a server costing Rs.933,559 was purchased for the National digitization project, which is functioning at the library.

The total value of the equipment purchased for the ERP software is Rs.6,864,960.

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Presently the software is at the final testing stage, where the fine tuning is carried out with the intention of implementing it at the earliest.

Although Rs.2,200,000 has been agreed as the contract price as per the agreement entered between the Institute and SARASA, only Rs.660,000 has been paid as an advance. According to clause 25 of the agreement, late charges are intended to be recovered when the final payment is made at the end of the ERP software development.

- (b) It is noted to use the procurement plan as an effective control mechanism by following a time plan when implementing procurement activities to avoid delays.
- (c) Steps will be taken to rectify the internal control system and SARASA software system is expected to be used in order to rectify control weaknesses.
- (d) As a payment delay was foreseen with related to certain procurement activities of the year under review and prior years, Rs.81 Mn. was deposited in the NIFS savings account no. 1-0015-01-03152 at National Savings Bank.

Out of the said deposit, Rs.29,967,389.51 has been paid subsequently for the payment of relevant works, while the rest is being currently utilized to meet the payments.

- (e) As per Public Enterprise Circular PED 1/2015, this service has been provided to the middle level managers of the Institution who are not entitled for a monthly transport allowance or for official vehicles. Further, the Institute has taken action to collect an amount from them on behalf of the respective service.

If there is any shortage in the amount charged for the service provided as per the said circular, steps will be taken to make a revision with the supervision of the Board of Governors.

3. Other Audit Observations

- (a) Due to the insufficiency of the allocated funds for Annual Research Review, it is necessary to obtain donations from outside parties.

Only Rs.355,000 was allocated for the 2018 Annual Research Review and the remainder of Rs.750,330.87 was collected from outside parties.

Expenses made from the annual budget fund allocation have been shown under Note 20 and expenses made from the donations received from external parties amounting to Rs. 750,330.87 have been shown as other income under Note 14A and as other expenses under Note 20A in the financial statements.

As it was not possible to identify the exact amount of donations for the 2018 Annual Research Review, and that the balance of that event will be used for the next year, this has not been included in the annual budget.

- (b) An amount of Rs.268,579.38 from the Research Fund, which is maintained using the balances of research and program events has been expensed to the "Competency

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Development Programme for Technical Officers” conducted by the National Human Resources Development Council of Sri Lanka.

Details of the 6 projects, which were inactive during the year under review with a cumulative balance of Rs.1,984,035 are as follows.

Bes Grant

The balance of the project has been maintained to meet the expenses such as sudden requirement to purchase chemicals or to carry out an emergency laboratory equipment repair or for an unforeseen transport expense.

HETC Project

Nanotechnology and Advanced Materials project which was a sub project of HETC project has ended in 2015. The balance money of that project is expected to be used for the Nanotechnology project.

IFS Sweden Grant

The project has ended, and it is expected to use the remaining money for the common research fund with Board approval.

Faculty of Natural Science (OUSL)

The project has ended, and it is expected to use the remaining money for the common research fund with Board approval.

Research Equipment

An amount of Rs.1,500,000/- was received to purchase a specific piece of equipment (Walking Gradiometer and GPS Option B with Adaptation Kit). NIFS has spent the full value, which is Rs.2,643,508.93 and purchased this equipment, and currently it is being used for field explorations. Necessary transfers and corrections were made to recover this amount from the Research Equipment grant in 2019.

National Workshop on Separation Techniques in NP

This is a balance left from a conference held in 2016 and it is expected to utilize this for the conferences and workshops conducted by the Natural Products Project during 2019/2020 period.

Technical Training Program

The project has ended, and it is expected to use the remaining money for the common research fund with Board approval.

Tissue Culture

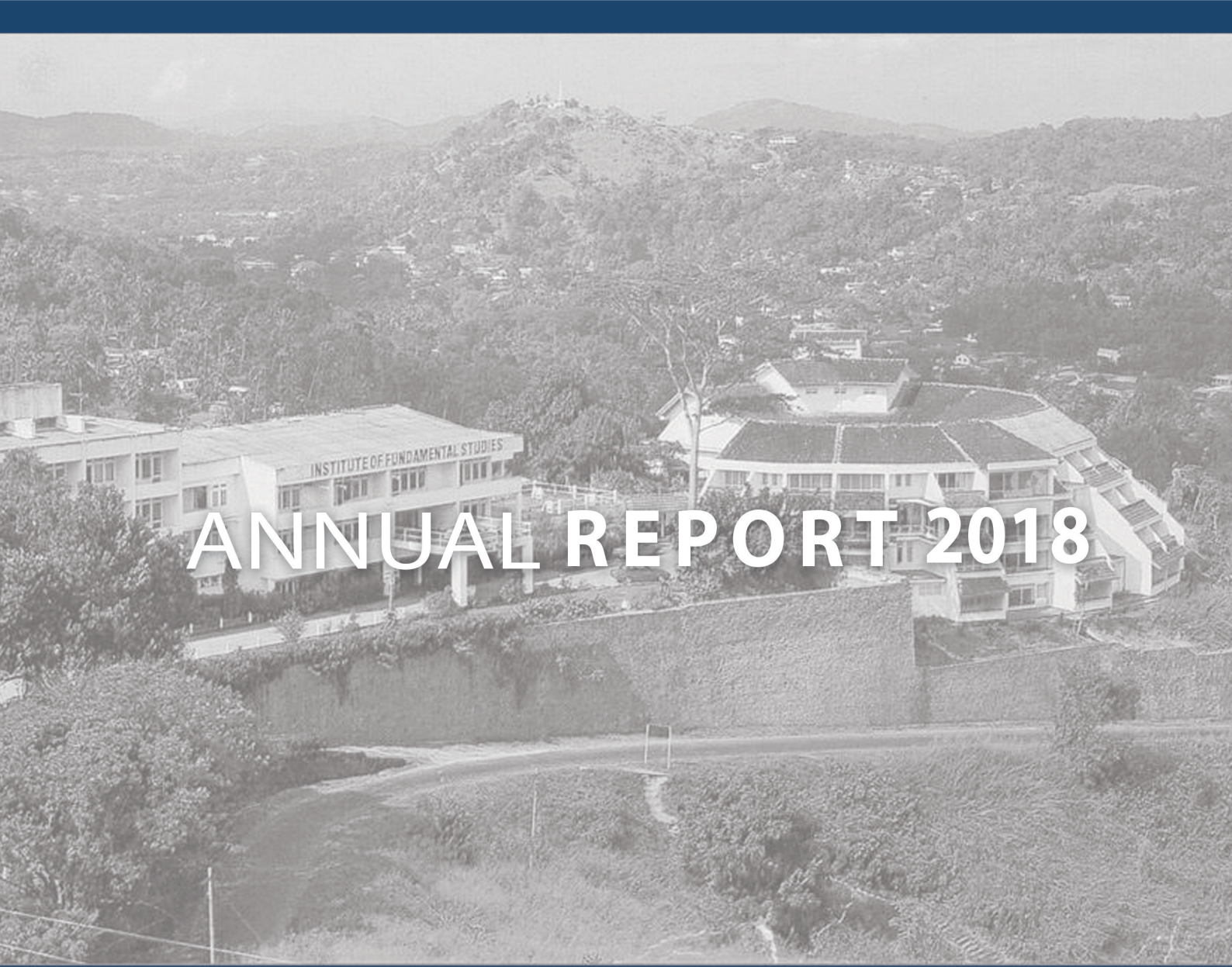
The project has ended, and it is expected to use the remaining money for the common research fund with Board approval.

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Rock Cutting

It is noted to utilize this money for the respective purpose.

- (c) Items of this order were released except for two items which were retained at the Customs. Approval for clearance was requested from National Dangerous Drugs Control Board and we have received a permit from the Central Environmental Authority. However, information was requested continuously by the National Dangerous Drugs Control Board and as a result we had to incur demurrage more than the cost of the items. Unfortunately, the items were not to be found at the Customs. After explaining the matter to the Board of Governors, the necessary adjustments were made.
- (d) It is noted to investigate the reasons and weaknesses which caused the revision of the 2018 procurement plan and to take corrective action to revise the 2019 procurement during the middle of the year and to obtain approval for the same.
- (e) It is noted to take corrective action related to the observations made at the earliest.



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